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PROBLEMS OF INTERNATIONAL MINERAL CONTROL

MANY of us, uplifted by the Atlantic Charter, may take that resounding slogan "equal access to raw materials" as a product of the modern democratic spirit. It would be well to recall, however, that it was used by the Germans during the War of 1914–18, and was repeated between wars by the Italians, the Japanese and others until it became the rallying call of the 'Have-nots'. We may first inquire as to how grievous was the inequality of access which the Axis Powers and the poorly endowed nations felt they suffered from, so far as mineral raw materials were concerned. Answers to this question and to a great many more in mineral politics are provided by a recent publication[1] of the Brookings Institution of Washington.

The uneven distribution of minerals—a distribution which cannot be altered—undoubtedly bore especially heavily on the Axis Powers. It has to be admitted that, apart from the coal, magnesite and potash of Germany, the bauxite, sulphur and mercury of Italy and the sulphur of Japan, little of the immense bulk and variety of mineral raw materials necessary for large-scale industry was available within their own borders. It may here be interpolated that their mineral position is not materially improved even with their boundaries temporarily inflated. Interchange of mineral products, as of other products, is accordingly unavoidable; no dictator, by taking any quantity of careful thought, can make his country self-sufficient in minerals—a fact brought home by the realization that even gigantic associations like the three chief 'mineral Haves', the British Empire, the U.S.A. and the U.S.S.R., are not themselves completely self-sufficient, either alone or in any possible combination.

To what degree, then, has equal access been denied to the 'Have-nots'? As the authors of "World Minerals and World Peace" demonstrate by maps and statistics, mineral raw materials have moved in gigantic quantities throughout the world. It has been the major preoccupation of most of the great mineral cartels and monopolies to find markets. Indeed, many of these associations were formed expressly to expand their mineral sales. The Axis Powers were invited, and even enticed and persuaded, to buy Canadian nickel, American oil, Russian manganese, Malayan tin, and so forth. To all who were able to pay, there was equality of access to buy. The price could not be the same to all buyers, any more than manufactured goods are available to all on an equal-cost basis; the cost of transportation, considerable with the majority of mineral products, controls this. Further, equality of access, as distinct from freedom of access, was affected to only a slight extent by the working of the many varieties of trade barriers. Export tariffs provided revenue for the exploiting country, import tariffs were designed to aid a home production. These controls, with quotas, embargoes and the whole fiscal kindred, gave rise to friction between combinations of consumers and producers,

but not between the 'Haves' and the 'Have-nots' as such. The removal of all trade barriers which are deliberately designed to offset the inequalities of mineral distribution would, as pointed out by Leith, Furness and Lewis, emphasize these inequalities and would contribute little to the solution of the general problem. These investigators conclude that most of the complaints raised by the 'Have-nots' arise from the strategic importance of minerals in time of war. Modern war is primarily a mineral war, and the relative poverty of minerals of the Axis Powers is a severe handicap to a career of aggression.

However dubious its origin may have been, the slogan "equal access to raw materials" has now become respectable and legitimized by Clause IV of the Atlantic Charter. The United Nations "will endeavour, with due respect for their existing obligations, to further the enjoyment by all states, great and small, victor or vanquished, of access, on equal terms, to the trade and to the raw materials of the world which are needed for their economic prosperity". It will be recalled that the Division for the Social and International Relations of Science of the British Association held a conference on Mineral Resources and the Atlantic Charter in July of last year. Among the findings[1] of this conference were recommendations which led the Council of the Association to appoint a committee, under the chairmanship of Sir Thomas Holland, "to enquire into, and report upon, the state of knowledge of mineral and metal resources, other than coal and petroleum, essential for modern industrial development from the point of view of the Fourth Clause of the Atlantic Charter". The report of this Committee has now been published[2].

The major problem of the Committee was taken to be to suggest methods for obtaining and keeping up to date the essential facts concerning mineral resources. The imperfections of our knowledge of the distribution of mineral deposits and the shortcomings of the statistics of mineral production and trade are clearly serious obstacles in the attainment of reliable data. The estimation of mineral reserves, even in well-surveyed ore-bodies, is at most times a hazardous proceeding. This applies with particular force to the reserves in certain fields which, though important, are worked by primitive methods. The Committee makes a plea for the classification of ore-reserves according to the degree of certainty of knowledge of them, and requests that the grade and quality of the ore shall, where possible, be specified. A distinction, and that a just one, is drawn between what a mining company might consider to be mineral reserves, that is, economically extractable ore, and what a nation might consider to be mineral reserves, which would include such resources that may exist but have not yet been brought under estimation.

The domestic resources of the United States are surveyed in comprehensive fashion by the National Resources Board. It is to be expected that the U.S.S.R. has exact information on its mineral production and its mineral deficiencies. The Committee advises that a similar survey of the mineral resources and capacity for mineral and metal productions of the British Commonwealth should be undertaken. It is to be hoped, the Committee continues, that after this War complete data on world mineral production will be available for an international organization through the activities of the various national resources boards. It is recalled that a mass of information on mineral deposits is buried in the confidential records of mining companies, while details concerning the activities of the greatest mineral company in the world, the U.S.S.R., are not yet published. The Committee urges, therefore, that, following the conspicuous example of the United States, each convenient national unit should establish a minerals and metals resources board to prepare a detailed assessment of its own resources, so that an international resources organization may be completely informed. It is further urged that reliable statistics of the quantity and grade of minerals used in each national unit must be available so that "the quantity of raw materials necessary for the economic prosperity of a country" may be assessed.

Among its conclusions, the Committee considers that "there is sufficient information already available to permit the framing of a general policy designed to regulate the flow of essential mineral supplies, from countries in which certain of them occur in excess of domestic requirements, to others which are deficient in the natural products required for their essential peace-time industries". The framing of this general policy is unfortunately outside the terms of reference of the Committee, but it would have been interesting, and perhaps entertaining, to have had some guiding lines from so distinguished a body. It is only fair to recall, however, that the equally distinguished framers of the Atlantic Charter clearly foreshadowed a policy of mineral control, but have unfortunately given us no clue to their plan. Is a plan possible, or even necessary?

There can obviously be no sharing-out of mineral deposits, nor can there be redistribution of colonial sources, nor can territorial adjustments be morally correct if based upon a mineral plan. We have seen that it is the opinion of the authors of "World Minerals and World Peace" that up to now there has been equality of access to buy for all who could pay. May not this very equality of access have been the root cause of the present troubles? Equality of access is excellent for a concourse of peaceful nations engaged in their lawful pursuits, though even here conflicting national needs may give rise to friction; but equality of access has hitherto allowed thoughtful aggressors to acquire and pile up stocks of war minerals in preparation for 'the day'. They have, moreover, been able to pay for them in many cases only by very questionable operations. This is the fundamental problem arising from Clause IV: since it is clearly just that all nations should have equal and unrestricted access to minerals for peaceful ends, by what devices can it be assured that minerals are not diverted to war-like purposes? The furnishing of the 'reliable' statistics of each country's peace-time requirements of minerals required by the British Association Committee would, we may be sure, give little bother to a potential aggressor. There is, of

course, an excellent and infallible method of solving the problem, and that is to have no wars or, in other words, to prohibit armaments. Who will prohibit, and by what armament is the prohibition to be enforced?

This matter of mineral control in relation to peace has engaged the attention of Prof. C. K. Leith of the University of Wisconsin ever since the War of 1914–18. Prof. Leith contributes a short final chapter on this topic to "World Minerals and World Peace". It is of interest to recall that plans for the allocation of the Allies' surplus mineral products among the defeated nations were prepared for the Paris Peace Conference; their serious discussion was prevented, most tragically, by devotion to other and less worthy topics. Realizing that the sanctions against aggressor nations provided for in Article XVI in the Covenant of the League of Nations were much too comprehensive to be effective, Sir Thomas Holland proposed in 1929 his 'Mineral Sanction', whereby the export of mineral products to any country breaking the peace was prohibited. As we see it and with regard to this present conflict, a fairly complete mineral sanction is in operation; the aggressors had, however, effected the obvious insurance—they had piled up enough spark-plugs to make sure that the tank would run for some time.

Leith is of the opinion that two primary requirements must be met to prevent stock-piling for war:

"The *first* is that there must be preponderant possession of the world's mineral resources by those who elect to prevent would-be aggressors from storing up supplies.

"The *second* is that machinery for the control of minerals must be in operation *prior* to the actual outbreak of war."

The mineral resources of the United Nations are at least three times as great as those of the Axis, and, with continued exploration, the factor will undoubtedly increase. The United Nations, therefore, *could* operate a mineral control. Such a control should be administered as a trust to ensure that minerals are allocated to nations in accordance with their needs for peaceful ends, and for these only. Its effective operation so that no stock-piling takes place would require supervision of various kinds—supervision of imports, supervision of uses, supervision of every phase of industrial activity. It would require also the closest co-operation between the countries producing minerals and an astounding lack of selfishness in nations and nationals. It would require, in other words, honesty among nations. Possibly some form of cartel for each mineral product, with an international governmental backing, might provide a reasonable middle course between complete nationalization or internationalization and the present structure of the mineral industry.

Leith, with the experience of the application of sanctions to Italy and of other episodes in the history of the League of Nations before him, pleads for planning *now*. He realizes, as the framers of the Atlantic Charter did not, that the use of force may be necessary for the working of any mineral control plan. Let us not confuse force with violence.

The greatest obstacles to the enjoyment of the natural wealth of the world by its owners, the people of the world, is that ancient and foul trinity which becomes more powerful with what we used to call progress—the trinity of ignorance, greed and fear. Physical planning with the head cannot remove the obstacles; spiritual planning with the heart may, for, after all, most of them are simply the consequences of plain sin.

[1] Leith, C. K., Furness, J. W., and Lewis, Cleona, "World Minerals and World Peace" (The Brookings Institution, Washington, D.C., 1943).
[2] *The Advancement of Science*, No. 7 (1942).
[3] Mineral Resources and the Atlantic Charter: Report of the Mineral Resources Committee, *The Advancement of Science*, No. 8 (August 1943).

RECONSTRUCTION OF ENGINEERING EDUCATION

RECONSTRUCTION plans for many branches of national activity are under discussion, and it is of the greatest importance that every grade of education should be examined critically, since the influence of changes, whether for good or ill, will certainly be more far-reaching in this sphere than in any other.

It is therefore eminently right that professional bodies should give immediate attention to the education of future recruits to their professions, and the Council of the Institution of Mechanical Engineers is to be congratulated on the timely publication of its considered views on this important subject[1].

The Institution claims, rightly, that it has a national responsibility, by virtue of its charter, for the maintenance and enhancement of the standard of education of all grades of mechanical engineers, and in discharge of this obligation it has for some time been giving attention to educational problems. The publication of the White Paper by the Board of Education provided an appropriate occasion to place on record the major conclusions which have emerged from the Institution's discussions.

The Council of the Institution speaks with authority, and although, as is proper, its report specifically relates to problems connected with the training of mechanical engineers, it may be said at the outset that much of it is equally applicable to other branches of engineering. The report is comprehensive, and will repay close study by those interested in this vital question—which should include all who are concerned in any way with the future efficiency and professional status of the engineer.

It is impossible to deal here with all the topics considered and the questions raised by the Report but some of them, at least, may be appreciated if we attempt to trace the educational path of the young engineer of the future who desires a university training, after the reforms suggested have been implemented. At the age of sixteen, having made up his mind to become an engineer, he will be faced with the first decision; whether to remain at school for another two years or to begin a works training. The answer may depend partly on economic considerations, but not so much as if he were living in the pre-war world, since there will be a well-considered plan

of State bursaries to ensure that all suitable candidates can enter their chosen professions. Perhaps the determining factors will be his aptitude for study and his personal predilections. If he is anxious to start practical work at the earliest possible moment he will, for three years, follow an organized training in works and technical college, being released for part-time day-work in the latter; this period will include any national service to which he is liable. He will then, at the age of nineteen, be ready to enter the university, where he will find the matriculation requirements more consistent with his previous education and experience than they were for his predecessors. At this stage he will, perhaps, meet an old school-fellow who remained at school and obtained the Higher School Certificate, or its post-war counterpart. This school-fellow will have served a year in part-time instruction in works on a national service basis and will now also be ready to begin his academic career. Both of them are State bursars and are therefore not handicapped by accident of place of residence or by lack of private means from securing their education.

The choice of university will not be a matter even of such importance as it is to-day, since the diversities of practice in regard to courses and custom which now exist will have been largely eliminated; one difference in particular will vanish—wherever our young men study they will need an extra year if they are not content with pass degrees but desire to obtain honours. (In this connexion the Report is not quite clear whether the Higher School Certificate will exempt from the pre-intermediate year as at present, that is, whether the two will start level in their academic careers.) Their experience in works will have given them a certain critical faculty, and this will be exercised on the teachers and equipment provided for their instruction. These will be found to be above reproach. The teachers will be, and will remain, engineers who have been trained to teach and are 'refreshed' at intervals either by a return to industry for a period of three months in each year for several consecutive years, or in some cases for a complete year at a time. These teachers will be paid adequately, and their prospects will be comparable with those which would have been open to them if they had followed industrial careers. Not only will they be kept up to date in the practice of their profession, however, but by means of refresher courses at a postgraduate college they will be kept in touch with the newest scientific developments in particular subjects; they will, moreover, add to these developments by their own researches, for which time will be made available and, in addition, will assist local industry as consultants in their specialized subjects. Finally, they will be encouraged to take part in the various activities of the professional institutions, and this will indeed be part of their regular work, for which they will be entitled to recover expenses from their governing bodies. At intervals our young undergraduates will miss some of their accustomed teachers for a time as they will have exchanged posts temporarily with their opposite numbers in universities either in Great Britain or abroad.

The equipment of the laboratories will be representative of modern practice and will be kept up to date by industrial organizations and associations. Here perhaps one may be allowed to express some doubt as to whether this proposal is the best possible, or even to be advocated. It will readily be agreed by those who know the conditions of many engineering laboratories that the standard of equipment is often "deplorably low", as stated in the Report, but it is doubtful whether in most cases general engineering machinery is suitable for instructional purposes. Specially designed plant is usually necessary if essential principles are to be taught, even perhaps at the expense of some lag behind latest industrial development. Doubt may also be expressed as to whether the "range of basic knowledge" is expanding quite as continuously as the Report suggests—applications certainly are doing so, but in teaching the undergraduate it may be wise to draw a distinction. Basic knowledge is the proper scope of undergraduate studies; special developments appear more properly in postgraduate courses.

During long vacations, students will be expected to spend at least eight weeks in gaining practical experience of one sort or another, and this will be arranged for them by their university co-operating with employers in industry.

In due course our students graduate and will then complete their practical training by spending sufficient time in works to bring the total period of works training up to not less than two years. If they wish to continue their academic work they can do so by spending one or two years in advanced study or in research, and the Report makes the suggestion that students of one institution should be allowed to do this at another which has specialized in a particular field. This is already done in many instances, but the principle might well be extended, even to the extent of making the Ph.D. degree of one university available only to postgraduate students from others; this would be in close accord with the original intention behind the establishment of this degree.

In some respects the proposals are not seriously dissimilar from existing conditions in many universities, but they are very far from those which obtain in technical colleges, particularly as regards the conditions of employment of staff, teaching hours, and encouragement of research. In this last connexion the Report in no way overstates the case when, in commenting upon the adverse effect upon superannuation of time spent on work other than teaching, it says "A more effective way of discouraging research would be difficult to imagine". It is the desire of the Institution that technical colleges, as well as universities, should conform to the standard suggested and it would like to see more full-time students in the technical colleges. It is stated that there is room in industry for a greater number of men of graduate rank than can be supplied by the universities and that suitable technical colleges should provide to a greater extent than at present full-time courses of degree standard.

This is open to discussion; it may well be argued

that the work of the universities and the technical colleges should be differentiated, rather than identified, and that they should be training men for different kinds of equally important work. If that were conceded, it might be necessary to extend to some extent the facilities in the universities, but still more probably it would entail a substantial increase in the provision for training in technical colleges. At present there appears to be a tendency for the universities and the technical colleges to overlap unnecessarily, and it cannot be an economical or efficient use of resources when, in the same limited area, a university grants its own degrees and one or more technical colleges prepare for degrees of another university. There is certainly enough work for all to do, but not necessarily of the same kind.

This article has concentrated on those sections of the Report which deal with the university training of engineers; many other important topics are excluded by lack of space. Practical training, for craftsmen as well as professional engineers; courses in technical colleges for craftsmen; and the allocation of available funds for educational reconstruction; are also discussed in the Report. On the last, a feeling of disquiet is expressed that the Board of Education places undue emphasis on "Buildings" as the end of all technical educational reform. It is to be hoped that the powerful influence of the Institution of Mechanical Engineers will be reinforced by that of other interested bodies to prevent this fear being justified by the event.

[1] The White Paper on Educational Reconstruction and its Impact on Training for Mechanical Engineering. (London: Institution of Mechanical Engineers, 1943.)

EDWARD TYSON, 1650–1708

Edward Tyson, M.D., F.R.S., 1650-1708, and the Rise of Human and Comparative Anatomy in England

A Study in the History of Science. By Prof. M. F. Ashley Montagu. (Memoirs of the American Philosophical Society, Vol. 20.) Pp. xxix+488. (Philadelphia: American Philosophical Society, 1943.) 5 dollars.

THE keynote of this book, as provided by Prof. Montagu himself, is an unbounded and emotional enthusiasm for its subject. Now enthusiasm may be a good and a beautiful thing, but if the enthusiast indulges in frequent and generous outbursts of it, his vision becomes blurred, and his opinions, to quote Mr. Sampson Brass, tend to verge upon the confines of injudiciousness. For example, Prof. Montagu ventures to bracket Tyson with Copernicus, Vesalius and Newton—a proceeding which the sober historian can regard only as a symptom of mental obscuration. Again, Tyson's competent but modest paper on the anatomy of the rattlesnake is described as a study of a reptile which has never been equalled before or since; his anatomy of the opossum "has scarcely ever been excelled"; his demonstration of the relations of apes and man (not even mentioned by Darwin) is an "epoch-marking event" which "exercised a profound influence upon the intellectual development of the eighteenth century"; his research scheme is "one of the finest expositions of the method of comparative anatomy which has ever been written"; his description of the anatomy of the porpoise was such "as had not before been given by anyone of the anatomy of any animal", and so on. Such statements cannot be justified, and do not even enhance the importance of Tyson's genuine achievements, which could have been less picturesquely stated without detracting from their legitimate claims on our admiration. Prof. Montagu should take to heart the wholesome advice of De Quincey—not to sink over head and ears in love, but to leave afloat a trifle of brain to overlook the whole conduct of the affair.

To complete the ungrateful task of criticism, we must regret that Tyson's valuable contributions to comparative anatomy, published and unpublished, are not critically examined and assessed, in consequence of which the reader is not advised what exactly Tyson had discovered, and to what extent he had corrected and extended the labours of his predecessors and contemporaries. This task, therefore, has still to be accomplished. Even Tyson's well-known work on the chimpanzee is not adequately analysed from the *anatomical* point of view, although such an undertaking would have been well within Prof. Montagu's competence as a professor of anatomy.

The merit of this work, therefore, lies in what Prof. Montagu has to tell us of Tyson's life and cultural environment, and here he has much to say that is new and of undoubted value. This part of the monograph would have been even more impressive had not the War cut short his last visit to England before his researches were completed. This affected particularly the work on the Tyson manuscripts preserved in the Royal College of Physicians and the British Museum, which naturally can be studied only in those institutions. The records of the Royal Society include much Tyson material, of which Prof. Montagu has made the fullest use. As a craftsman Tyson cannot be compared with Casserius, Malpighi and Swammerdam; but his scheme for the promotion of a science of comparative anatomy, which he did not live to implement, shows that he had a more prophetic and philosophical outlook than his seventeenth-century contemporaries. Prof. Montagu is particularly admirable on this theme, as he is also in his essay on Tyson's remarkable monograph on a young chimpanzee, although here Tyson owed much to the assistance of Cowper, and in his other work to Waller. Not much is known of Tyson's life, but Prof. Montagu seems to have exhausted all possible sources, and it is therefore scarcely likely that we shall ever know more. His account of the history of the skeleton of Tyson's chimpanzee, now in its final resting-place in the British Museum, is particularly attractive. An extensive, and with few exceptions accurate, bibliography is appended.

Prof. Montagu appeals for corrections, and here are a few of the more relevant points which have been noticed in reading this original and important work. Pp. 50–1: Attention is here directed to an unusual bibliographical problem. Tyson has been credited with having published in 1669 a work on the *Rhymes* of the Ancients. This, as Montagu rightly points out, is a mistranscription of the *Pygmies* of the Ancients of 1699, but the mistake has been extensively repeated in various bibliographies. Montagu ascribes the error to Munk in 1878, and severely criticizes him for it. Who first started this bibliographical hare the present writer is not prepared to say, but it was certainly not

Munk, who simply copied it word for word from Watt's "Bibliotheca Britannica" of 1824. P. 58: Redi 1671. There is evidently some confusion here. The work by Redi is not correctly quoted or described, nor was it translated by Waller. P. 122: "Jan Jocobsz [Jacobsz.] Swammerdam" was Swammerdam's father. P. 137: Tyson's Faithorne was the father (1616–1691), not the son. Pp. 152–3: The tapeworm described by Tyson was *Taenia pisiformis* of the dog, of which he examined the external characters only, and, even so, unaccountably failed to observe the suckers of the scolex! He does *not* give us a minute and perfect description of the anatomy of the worm. The worm figured on p. 153 is obviously not a Bothriocephalid but a Taeniid—probably *Taenia saginata*. P. 161: *Rana piscatrix* is not a frog, but the fish *Lophius piscatorius*. P. 169: Tyson cannot be acquitted of the belief that the peccary had three stomachs. His language is unmistakable, and he even compares the three stomachs of the peccary with the single stomach of the common pig. Pp. 184 and 388: Tyson did *not* discover the cochineal fly. His figures represent one of the Coccinellid predators of that insect. P. 196: Hartmann recognized the animal nature of hydatids in 1685 before Tyson. P. 211 and also bibliography and index: Powers is the possessive case of Power. P. 283: The progressive diminution of the thymus during life was known to Galen. P. 327: Neither Tyson nor Hale discovered the human allantois, judging from Hale's paper. P. 357: Tyson's "yellow gurnard" was *Callionymus lyra*. P. 382: Perrault's philosophical views on comparative anatomy do not appear in the Parisian memoirs, but in his "Essais de Physique", and they compare very favourably with those expressed in Tyson's "Preliminary Discourse". P. 390: Grew (1675 and again in 1681) was the first to use the expression comparative anatomy in the title-page of a book. P. 408: In the Opera Omnia of Tyson, published in 1751, the unsold copies of the first and only edition of the anatomy of the Pygmie of 1699 were bound up with reprints of Tyson's other works. A comparison of the two "editions" of the Pygmie work shows that they are absolutely identical in every respect, and the relative scarcity of the 1751 edition is due to the small number of copies of the Pygmie which were available for this issue.

F. J. COLE.

ADVANCES IN BIOCHEMISTRY

Annual Review of Biochemistry

James Murray Luck, Editor; James H. C. Smith, Associate Editor. Vol. 12. Pp. ix+704. (Stanford University P.O., Calif.: Annual Review, Inc., 1943.) 5 dollars.

THIS, the twelfth volume of the "Annual Review of Biochemistry", is a remarkable production in that it shows so little evidence of war and all that war is meaning to the scientific worker. We need not recapitulate the difficulties which face the research worker; easy exchange of information and of publications is a thing of the past, and the censorship and import regulations have added greatly to the difficulty of our getting much-needed scientific books from the United States. In those many sections of scientific activity which make up biochemistry, the "Review" is more than ever useful in keeping us in touch.

The volume contains the usual articles on progress in what may be termed standard sections of the subject, but we would direct attention more particularly to the sections in the latter half of the volume as examples of its utility. Experimental progress waits largely on an advance in technique such as is afforded by the recent development of microchemical methods: it is affirmed that chemical behaviour remains essentially unchanged when only 10^{-8}–10^{-10} gm. of matter is used. The section describing the developments in these methods is most helpful.

There is a report for the first time on the electron microscope, which has progressed rapidly since the building of the first compound instruments ten years ago.

In the study of the biochemistry of micro-organisms there has been a striking shift in emphasis, changing to the study of microbial nutrition from that of metabolism. Many growth-factors have been identified with typical vitamins, so that the results have a direct bearing on the nutrition of higher organisms. The report includes a summary of work on anti-bacterial agents such as the sulphonamides and penicillin. Synthesis of vitamins by culture of Torula yeast on wood-sugar and other industrial wastes has been known for some time, and such work is being extended.

The demonstration that plant viruses are protein macro-molecules brought the chemist and the physicist into this field. The review describes the formation of acetyl and phenyl-ureido derivatives of tobacco mosaic virus and their inoculation into susceptible hosts. The experiments are thought to show that infecting virus molecules may not necessarily function as exact patterns for reproduction, while a large proportion of certain functional groups of the virus molecule may be changed without appreciably altering the virus activity. There is much work on tobacco mosaic virus, including the determination of its constituent amino-acids.

No subject is more to the fore to-day than nutrition, and there is a stimulating report on it. In Great Britain much is being done to persuade a conservative and ignorant public to eat the proper things, and there is a marked change for the better in general health in consequence. The value of an improved diet during pregnancy on the course of pregnancy, labour and convalescence of the mother and on the general well-being of the baby is firmly established, and action has been taken to make it available here. For the masses the lack of oranges and other fresh fruits is a serious disability; the vitamins lost are only very partially made up from vegetables, which are very hard to obtain fresh in the cities, where they are most needed. Vegetables also are far too dear, almost beyond the purse of many, and it is a reflection on the Ministry of Food that while recommending us to eat more vegetables we are not safeguarded against extortion.

Space restricts any more detailed reference to the other sections, though we may mention the steady but slow progress in the study of the proteins. This is difficult and somewhat unfashionable work, but we are behind in our knowledge. In discussing the sugars, emphasis has been placed upon the effect of unsaturation in directing and influencing not merely carbohydrate reactions but also biological reactions in general.

The editors and their helpers are to be congratulated on a most useful piece of work.

E. F. ARMSTRONG.

A Text-Book of Organic Chemistry

Historical, Structural and Economic. By Prof. John Read. (Bell's Natural Science Series.) Third edition. Pp. xiv+703. (London: G. Bell and Sons, Ltd., 1943.) 12*s*. 6*d*. net.

PROF. READ has taken advantage of yet another reprinting of his deservedly popular book to keep the subject-matter abreast of current advances. Although the operation had to be effected without upsetting the pagination, considerable ingenuity has been exercised in the successful execution of this delicate task. Without such restrictions the author would undoubtedly have made extensive alterations and additions, as a piecemeal revision of this type can never be entirely satisfactory. It is therefore not difficult for the reviewer to direct attention to a number of desirable additions and deletions, although it may be somewhat unfair in the circumstances. In particular, some mention of crotonaldehyde and the ethanolamines, both of which combine theoretical with industrial interest, might have been made; less emphasis could have been given to wood distillation as an industrial process, and the fact that a number of sex hormones have now been isolated and their structures determined could have been noted. In view of recent developments in the United States, it is unfortunate that the expression "the nitroparaffins have little practical importance" should have been allowed to remain. It might be pointed out that vitamin A has now been obtained in crystalline form and that the vitamins of the B, E and K groups are sufficiently well characterized to deserve passing mention.

None of these omissions, however, detracts seriously from the unquestionable value of this fascinating treatment of organic chemistry. On the contrary, the useful revision of the sections on petroleum and the electronic theory of valency, the latter including some discussion of resonance concepts, the inclusion of a modern formula for a polysaccharide and references to sulphanilamide, *M* and *B* 693 and to the electrophoresis of proteins, to mention just a few points, combine effectively to bring this reprinting up to date.

E. R. H. JONES.

Intermediate Chemistry

By Prof. T. M. Lowry and A. C. Cavell. Third edition. Pp. xvi+876. (London: Macmillan and Co., Ltd., 1942.) 12*s*. 6*d*.

FIRST published in 1936, and revised in 1938, this excellent book has again been brought up to date by alterations in several important sections—in particular those dealing with carbon monoxide, the rusting of iron, the distillation of liquids, organic analysis, and the organic derivatives of ammonia. Many additional numerical problems have been provided, and improvements in the experimental sections—nearly two hundred of them—have been introduced.

Its purpose being "to provide a complete text-book of chemistry for Intermediate and Higher School Certificate examinations", the volume is accordingly divided into six parts, headed, respectively, general and theoretical, typical elements, transitional elements, analysis, physical chemistry, and principles of organic chemistry. True, a candidate for one of these examinations who had fully mastered its content would be remarkably well prepared; but wise teachers who tolerate examinations, and conscientious students who utilize them, are likely to discern in this very circumstance the real aim of the authors. This, quite evidently, is not merely to elongate any pass list, but to help to lay a solid foundation of accurate chemical knowledge and intelligent appreciation; a foundation which retains familiarity of design while providing truly adequate footings for the support of a necessarily weighty building in the modern fashion. Though described as an examination text-book, therefore, it is not a cram book. Indeed the authors, when discussing the habit of the individual trees, frequently direct attention to one or other aspect of the wood; and this serves to promote a balanced view and to maintain a sense of orderliness which contributes much to the reader's interest and holds his attention.

Chemical Industries

Edited by L. Ivanovszky. Eighteenth edition, largely rewritten and revised. Pp. xxiv+360. (London: Leonard Hill, Ltd., 1943.) 15*s*.

IT would be difficult to arrange the experimental sciences in an order that would tally with their relative importance in everyday life, but chemistry would undoubtedly occupy a very high place. Far away and long ago their applications played a very minor part; here and to-day they are almost indispensable. It is true that these applications relate very largely to the material side of our daily life, but unless we go forward with the march of civilization, look to increasing our wants as well as our needs, and extending our comforts, we shall fall behind as a progressive people and sink into the limbo of the 'have been'. These reflexions arise from a perusal of the latest edition of Leonard Hill's "Chemical Industries", which is replete with the information required by manufacturers, merchants, consumers, and by those numerous 'impure' chemists who traffic in the applications of their science to material human wants. This new edition is considerably larger than the old. The glossary of industrial chemicals has been increased by more than one half; the tables of physical and chemical constants have been revised and extended, and many new data concerning organic and inorganic compounds have been added. Further, entirely new subsections are incorporated dealing with metals and alloys, non-metallic materials, chemical plant and instruments, and the older ones on pharmaceuticals and perfumery raw materials have been replaced by new. Power plant, water-treatment, handling, conveying and transport are other sections of this very useful compilation.

E. H. T.

A System of Qualitative Inorganic Analysis

By Dr. J. L. B. Smith. Second edition. Pp. viii+64. (Cape Town, Bloemfontein and Port Elizabeth: Nasionale Pers Beperk, 1943.) 4*s*. 6*d*.

THIS work on qualitative analysis is intended purely as a laboratory manual, since the physico-chemical principles underlying analysis are not discussed and very little is said about the nature of the chemical reactions involved in the tests. These omissions, together with the use of a very large number of abbreviations, give the text rather a forbidding appearance, and the reader the impression that qualitative analysis is purely a mechanical operation of adding so much of one substance to so much of another. The book, however, contains some notable features which deserve consideration by students of advanced chemistry. Thus a systematic scheme has been worked out for the detection of all the common anions, and very precise details have

been provided throughout for carrying out the tests under the right physical conditions. In choosing the tests the author has guarded, so far as possible, against the mutual interference of ions, and this is typical of the care he has taken throughout to ensure success to the user of his system of analysis.

A. C. C.

A Dictionary of the Fungi

By Dr. G. C. Ainsworth and Dr. G. R. Bisby. Pp. viii +360. (Kew: Imperial Mycological Institute, 1943.) 20*s*.

FOLLOWING the lines of Willis's well-known "Dictionary of Flowering Plants and Ferns", Ainsworth and Bisby have included in their 339 pages a mass of useful information. In addition to generic names, with a reference to the family and a brief note as to habitat, they have provided explanations of technical terms, though unfortunately without their derivations. Students with "little Latin and less Greek" may be puzzled, for example, to find under *plano-* both planogametes and plano-convex, even though the terms *plane* and *planetism* are defined in the preceding lines. Useful notes are given on some of the older mycologists, and such popular terms as *devil's snuff box* are not disdained.

It is perhaps inevitable that, in a work of this kind, detail should be uneven. Thus under *sex* one learns that Pyronema—that classical fungus—has a trichogyne but not that it has an antheridium, though the non-motile sperms of the Laboulbeniaceæ are mentioned and both trichogyne and antheridium are illustrated in Fig. 54.

An interesting detail is that the book (apart from its appendix) is written in Basic English, but the simplicity which this suggests is lessened by the mass of technical terms. Comparatively few of those who look up the meaning of *metula* will be much wiser when informed that it is "a sporophore branch having phialides". It could be described nearly as briefly as "a branch bearing spores on flask-shaped outgrowths". The explanation of even superfluous technical terms may be of value, but their use is to be deprecated. Mycology is burdened with far too extensive a vocabulary, and the only serious criticism of this convenient little book is that it may revive words which were mercifully becoming obsolete.

Map Projections by Practical Construction

By A. Hinckley. Pp. 84. (London: George Philip and Son, Ltd.; Liverpool: Philip, Son and Nephew, Ltd., 1942.) 3*s*.

FOR students of limited mathematical ability, books on map projections usually have an arid and unattractive appearance. This little book—which assumes only an elementary knowledge of mathematics and provides simple practical constructions for a large number of projections, together with many exercises that bring out the value for many purposes of the study of the subject—is notably unusual in its treatment, and has the commendation of no less an authority than the secretary of the Royal Geographical Society. There is no doubt that the teacher of mathematics or geography—especially of the former—who is reasonably emancipated from examination limitations, will find in this book ample scope for much valuable work, and any student who follows it diligently will not only solve a large number of interesting mathematical problems but also acquire a considerable practical knowledge of the geographical applications of the study of map projections.

For the student of geography, who is primarily concerned with the selection of the most appropriate projection for any particular geographical purpose, the book is, however, somewhat limited in being severely practical. Both teacher and student would appreciate a clear preliminary presentation of the problems involved in mapping the globe, and a systematic discussion of the relative value of different projections for different purposes, in addition to the incidental comments that are found in the book. At the same time it is recognized that the numerous excellent exercises cover a wide range of matters of interest and importance to the geographer.

L. S. S.

Simple Experiments in Biology

Compiled by Cyril Bibby. Pp. xii+164. (London and Toronto: William Heinemann, Ltd., 1943.) 7*s*. 6*d*.

THE author of this useful book is education officer of the Central Council for Health Education, and joint editor of *Biology*. He is therefore very well acquainted with the practical needs of biology teachers, and the guidance they require. No specialized knowledge on the part of the teacher is assumed and no expensive apparatus for experiments is required.

The book is essentially practical; the theory being left to the more orthodox text-books. Descriptions are explicit, and the whole course is comprehensive. The only criticism we have is that, although there may be several reasons for not inserting an index in this type of book, we still think its omission is to be deplored.

It is doubtful if there is any other book quite like this, and we would strongly recommend its adoption in all classes of biology up to, and including, school certificate standard.

Hermaphroditos

The Human Intersex. By Dr. A. P. Cawadias. Pp. ix+78+9 plates. (London: William Heinemann (Medical Books), Ltd., 1943.) 15*s*. net.

THE intersex or free martin has always been a subject of great interest in medicine, in literature and in mythology. Dr. A. P. Cawadias develops his scheme of classification of androgynoids and gynandroids from a basic description of the physiology of sex formation and of the physio-pathology of intersexuality. Case-histories and illustrations of the various types of abnormalities are given, and there are some notes on the lines of treatment.

Studies on Immunisation

First Series. By Sir Almroth E. Wright. (Researches from the Inoculation Department, St. Mary's Hospital, London, W.2, Vol. 3.) Pp. xi+421. (London: William Heinemann (Medical Books), Ltd., 1943.) 25*s*. net.

THIS third volume in a series of the collected researches of Sir Almroth Wright contains reprints of papers on work done in the first decade of this century and originally published in 1909. The survey covers the antibacterial elements of the blood fluids, agglutinins, bactericidins and opsonins, and proceeds to vaccine and serum therapy.

POST-WAR NUTRITIONAL RELIEF IN EUROPE

THE English Group of the Nutrition Society discussed the "Scientific and Medical Aspects of Post-War Nutritional Relief" at a whole-day meeting held at the London School of Hygiene and Tropical Medicine on November 6. Lord Horder, who took the chair, remarked that the programme spoke of the scientific and medical aspects of the problem, not of the political, and he would endeavour to see that this intention was carried out. He sketched the contents of the official document setting forth the benefits which the United Nations Relief and Rehabilitation Administration (UNRRA) would confer on the nations whose representatives had subscribed to the document. Each of these nations is to be represented by one member on a Council which is to meet at least twice a year. In Lord Horder's opinion there is a gap in the machinery in the lack of a Supreme Economic Council to plan co-ordinated supply, and he thinks that the relation between the military administration of relief and the Relief and Rehabilitation Administration needs defining.

Conditions in Europe

Experiences of the War of 1914–18 and since, and the current state of nutrition in occupied Europe and elsewhere, were discussed by Prof. J. R. Marrack (London Hospital and Committee for Co-ordination of Nutrition Surveys). During and after the War of 1914–18, the shortage of food was due much more to the neglect of agriculture than to the blockade. The total production of cereals in continental Europe was reduced by one third, and did not again reach the pre-war level until 1924. Livestock was reduced to 30 per cent in Poland, and the animals everywhere were very much underfed. The milk supply in Germany was 30 per cent of the pre-war amount. Freedom to trade was not restored to the ex-enemy and adjoining countries until April, and, in the case of Germany, until June 1919. Transport was hopelessly dislocated and local fighting still going on. Special machinery had to be set up or 160 million people would have been faced with great privation. All supplies provided by such special machinery were classed as relief and were almost entirely supplied by special credits, chiefly from the United States, or paid for in cash by the Governments of the recipient countries. Distribution was through the normal channels of trade, co-operatives or local authorities. Food was supplied in this way to twenty-one countries with a population of 230 millions, but relief was not continued after September 1919, except to children as canteen meals financed by charity.

The quantity of supplies imported into the countries other than the Western Allies and the neutrals was considerably less during 1919 and 1920 than during 1913, although food production was so much reduced. Only those children who showed signs of under-nourishment were fed, and these, at the peak periods in April 1920 and 1921, numbered, respectively, 3½ and 2¾ millions. A large proportion also of adults must have needed more food and, though suffering was reduced by it, the relief sent was inadequate and stopped too soon.

Of the supplies sent, 60 per cent was flour and grain, though qualitatively, meat and milk were much more needed. The supplies sent for the children included food in unfamiliar forms which was often refused. The inadequacy of the relief is shown by the amounts of supplies to other countries. The total relief supplied in the five years, 1919–24, was less than the sum of imports of wheat and flour, meat, bacon, ham and sugar, into the United Kingdom in the one year, 1918. Similarly, the amount of pork products was less than one tenth of the total consumption of pork products in the United States in 1919. Only surplus products were sent as relief, regardless of their suitability, and, if food had continued to be rationed in Great Britain alone, far more would have been available for relief.

After the immediate post-war period, the Russian famine occurred in 1919–22, in which three million people died of starvation; this should be taken as a warning of what may occur if adequate preparation is not made. It is unfortunate that Dr. Melville Mackenzie has written of choosing which age-groups of the population should be fed and which left to die, as if this choice was inevitable and not a sign of failure.

When the present state of affairs is considered, the fact that food is rationed over most of the continent of Europe makes it possible to estimate that the average normal consumer is not getting more than 1,400 calories daily. The degree of deficiency varies from Greece, Poland and Spain, where the daily intake is less than 1,000 calories, to Germany, where it is about adequate. The deficiency of animal products is severe owing to slaughter of livestock. The effect of lack of food is seen in the increased death-rate from tuberculosis, which was a marked feature of the War of 1914–18 also. Some cases of famine œdema have been reported from Belgium. Rickets is said to be controlled by widespread distribution of vitamin D. The large amount of potatoes being grown should ward off scurvy. Fortification of the margarine with vitamins should prevent vitamin A deficiency if the supply of vitamin A holds out, but disruption of the transport of green vegetables may increase the risk. Use of flour containing a very large proportion of the whole grain should prevent gross deficiency of the vitamin B complex except in the maize-eating countries. This is the picture in Europe. From China we have little information, but the situation there may be the worst of all.

Surgeon-General K. Evang (Public Health Services, Norwegian Ministry of Social Welfare) stated that after the War of 1914–18 the most outstanding shortage was that of fats, the craving for which caused the greatest suffering. Rubner directed special attention to the effect of semi-starvation in causing mental deterioration, lethargy and indifference. In Denmark the exportation of butter caused the appearance of some hundreds of cases of blindness from vitamin A deficiency, but this only lasted until the blockade prevented the export of butter. It was very remarkable that the increase in the death-rate from tuberculosis, which was so marked in many parts of Europe, was in Vienna relatively greater among the better classes, because the deterioration in their food was relatively so much greater.

In the present War, production has not been so greatly reduced. The area dominated by the Germans is much larger and richer, and the Germans themselves are unlikely to suffer deprivation. Their food policy has not been the same in all countries; they have not looted them all and have even imported food into some.

The addition of 600 calories daily proposed as

relief is not to be regarded as sufficient supplement to the average existing intake of 1,400 calories, though it can be used as a working basis. It is unfortunate that there is no criterion for the onset of a dangerous state of malnutrition except the returns of morbidity and mortality. The state of nutrition of political prisoners in the hands of the Gestapo must be very bad, since they are not treated as prisoners of war and may not receive parcels. There have been marked rises in the number of cases of poliomyelitis, cerebrospinal fever, erysipelas, diphtheria, pneumonia, scarlet fever, gastro-enteritis and scabies.

In practice, calories should be supplied first as grains and fats. Treatment should be just, as between the hungering nations; but justice should remember the differing peace-time standards of the various countries, and no country should be offered smaller rations than under the Germans. The supply of sea food in Norway could quickly be increased by a supply of new fishing equipment. All plans must be dominated by considerations of transport, production and the needs of economic warfare.

Dr. Geoffrey Bourne (University Laboratory of Physiology, Oxford) gave a sketch of the number of calories supplied as rations in the different countries in 1942. No attempt has been made by the Germans to feed the Russian civilians at all. The occurrence of anæmia and hunger œdema, and of deficiencies of vitamins C and D, calcium and riboflavin is anticipated.

Post-War Agricultural Production

Problems of production in relation to post-war nutritional relief were dealt with by Dr. J. Hammond (School of Agriculture, Cambridge, and Inter-allied Technical Advisory Committee on Agriculture). He pointed out that the manner of administration of relief will depend on whether countries are liberated separately, or together, and how far they have been destroyed. The shipping position will be of primary importance. The first phase must be based on supplying in all countries the minimum requirements needed for human life before any one country receives more. The rationing scale in Great Britain is taken as such a minimum basis. Five times as much land is needed to produce 1,000 calories of livestock products as of potatoes or bread; milk represents a more economical conversion from plant to animal products than meat does and should, therefore, have priority.

In supplying relief the production of the country concerned should be encouraged to the maximum extent and imports should supply the rest. Production of energy food must come first; in occupied Europe the actual production of crops has probably fallen by about 10 per cent, but that of livestock by 20–30 per cent. Relief should include a supply of agricultural machinery and fertilizers, so that production of potatoes, sugar beet and wheat or rye can be enhanced to the utmost; seed of suitable local varieties should be conserved for sowing. Crop production should have been restored to normal by the second harvest after liberation, but animal production will probably take eight years to re-establish fully, even if preference is given to female animals with artificial insemination from good bulls, and special veterinary care to raise health and fertility. Extra feeding stuffs should be provided by the offals from imported grains and, at a later stage, dairy cows might be imported from North America. Supplies of meat could be most rapidly increased by encouraging the rearing of pigs and poultry.

Of foods imported from abroad, cereals should come first where needed, and condensed and dried milks for mothers and children should have priority, but there should also be early emphasis on meat and fats. If tropical oil seeds are imported whole, the residue could be used for feeding cattle. Meat, dehydrated to save shipping, should be imported for a considerable time to permit of livestock recovery.

The machinery to carry out the programme has been set up. The Allied Post-War Requirements Bureau in London has defined the requirements of each country to be satisfied by the United Nations Relief and Rehabilitation Administration in co-operation with the Allied Military Government of Occupied Territory. The machinery for a longer-term policy was considered at Hot Springs. In Great Britain we have our part to play. Agriculture must, if anything, still further increase production, and we must anticipate a continuation for some time of rationing of animal products.

Miss Margaret Digby (Allied Post-war Requirements Bureau) stressed that the problem is one of applying limited resources to secure the maximum effect, but that we are more fortunate now than in 1920 because of the great progress in the organization of agriculture which has taken place both before and during the present War. The farmer now has confidence in the organization of agriculture, and managed production is thus made easier.

In liberated countries it will be necessary to change the machinery and type of rationing, which the enemy has imposed, to something more acceptable, and to encourage production by a supply of desirable goods for which the foodstuffs produced can be exchanged rather than for a currency regarded with suspicion. The rise to higher nutritional levels will have to be gradual, and the feeding of people displaced and on the move will need special machinery. Dr. P. L. Yates (Ministry of Economic Warfare) mentioned that special inducements to farmers to produce might be offered on a points rationing system, based on the amount produced. Production overseas must be further augmented. The surplus wheat would clearly now be insufficient, but it would be useless to offer surplus beans to people to whom beans are unfamiliar and unacceptable.

Nutritional Relief in the Field

The problem of the organization of nutritional relief in the field was discussed by Dr. Audrey Russell (Medical Director, International Commission for War Refugees). The problem is far beyond the scope of voluntary organization, but the experience gained by voluntary organization may be useful. Relief on the large scale should be through the ordinary channels of trade and the social services, and through whatever survives of the organization of local government. It is through the social services, welfare centres and hospitals that opportunities for research may be found. Before any scheme can be started, a survey should be made of population, rations, local supplies, markets and businesses, fuel, water supply, transport and so forth, to be checked against official information. Bakehouses and bread constituents should receive special attention.

In Spain and France, the International Commission for War Refugees helped to supplement the rations of the static population by supplying weekly parcels of lentils, rice, sugar and tinned food to families in their own homes. They fed refugees on the road, and in transit centres and semi-permanent camps,

and they provided extra milk and cereals for pregnant women and children and adolescents. For orphans and abandoned children, colonies were organized. Camps should not exceed 5,000 in number, and the sections should not include more than 1,000 each; each section should have an elected committee of 10, of whom one should sit on a central council. The ration cards for those receiving relief should register occupation as well as other details, so that appropriately trained persons can be summoned by loud-speaker to the vocation which is needed to help in the relief scheme; the people to be relieved are thus made as self-reliant as possible. In Catalonia, when the official ration in 1938 had fallen to 980 calories, the school-feeding scheme included provision of rest in the open for debilitated children while being taught at school. The children could thus live at home, so that it was not necessary to remove to a colony any but orphaned or abandoned children.

Prof. E. Nobel (formerly professor of children's diseases, University of Vienna) gave an account of the organization which was set up in May 1919, by Mr. Hoover on behalf of the U.S. Government, for feeding debilitated children in all lands. The freight charges were paid by the recipient countries. The food was supplied cooked and was eaten on the spot. The children were selected according to bodily condition, regardless of race, creed or political opinion. Their bodily condition and nutritional needs were assessed according to the Nem System of Prof. Pirquet.

Nutritional Research

Opportunities for nutritional research in the work of relief were indicated by Miss E. M. M. Hume (Lister Institute). The successful expedition to Vienna which Dr. Harriette Chick led for the Lister Institute and the Medical Research Council in 1919 proved that research in immediate post-war conditions can be made to yield valuable results; but this research should be only such as can be carried out nowhere else. The shape of post-war research will be the same now as then, but the tempo will have to be much quicker lest the research material is destroyed by relief; the first approach would be a scouting expedition.

At the end of the War of 1914–18 the Central Empires were completely ignorant of all the work on vitamins done in the English-speaking countries, so that ignorance reinforced the lack of food in promoting deficiency diseases. The first expedition to Vienna in 1919–20 was a reconnoitring expedition in which rickets, scurvy and adult rickets or hunger osteomalacia were investigated. The research was carried on throughout in close co-operation with the relief organizations, as should always be the case, and cases were found in hospitals, convents and sick benefit organizations. The relief missions were helped with advice.

Throughout the preliminary period an opening was being sought to make a planned crucial experiment on the occurrence of rickets in human infants. The opportunity was found at the University Kinderklinik, where Prof. Clemens von Pirquet had devised a system to suit famine conditions, by which infants were fed on a high proportion of carbohydrate and no vitamins. Approach was made to him through a distinguished neutral intermediary, Prof. Wenckebach, of Holland, and, with an extraordinary degree of international co-operation, Prof. Pirquet consented to allow this group of ex-enemy foreign women to carry out the experiment, which lasted from 1920 until 1922. The undertaking had the highest official backing from home, without which work in such conditions would at any time be impossible. Prof. Pirquet was inclined to believe that rickets was due to a low-grade infection but, when the contrary was proved, and rickets occurred and was then cured with cod liver oil, he acclaimed the result.

Although the investigation was so long drawn out, its shape was that of the preliminary reconnaissance in which alone observations or therapeutic trials could be made, followed by a planned experiment posing a special question and demanding the maintenance of negative controls. These main lines will remain the same to-day. Twenty years ago, the chief interest lay in the cure of florid deficiency states; to-day interest is greater in minor states of deficiency which may be utilized as criteria in assessing nutritional status, if their specificity can be established. This knowledge is especially needed for fixing the requirements of vitamins, to which there is a tendency at present to attach excessively high values. It should also be of the greatest help to those having the relief to do.

Whether the present War will offer any scope for the planned experiment, which demands the maintenance of negative controls, is uncertain. It is the possibility of legitimately obtaining negative controls for a human experiment which justifies the making of the experiment in such circumstances. There is not much likelihood that ignorance will provide the negative controls to-day, and it is to be hoped that insufficiency of relief will not do so either.

There are two rules which anyone trying to do such research should observe: to do only work which can be done nowhere else, and to remember that research workers are regarded as mainly a nuisance by the civil and military administrations.

Dr. A. P. Meiklejohn (Oxford Nutritional Survey) agreed that the first contact should be a reconnaissance, but a reconnaissance in force with mobile teams making rapid surveys of nutritional status by the various criteria nowadays recognized. Miss Hume disagreed with Dr. Meiklejohn as to the degree of reliability which can be attached to some of these criteria for assessing nutritional status; she believes that research should be directed to determining their reliability and specificity.

Summary

Lord Horder summed up the discussion. He admitted that it had not proved possible to keep the academic aspect of relief problems wholly distinct from the political. It was clear that the problem of supply could not be solved by mere transportation of surpluses. The problem is much deeper and more extensive than is commonly understood. Supply should be based on the minimum requirement as represented by current rations in the United Kingdom. He was of opinion that these should be reduced for some months in order to increase the supplies available for relief. The feeding of the Fighting Services might also be brought under review and some food thus released, and the extra protein ration for heavy workers might be cut for the same purpose. For research, new tools and new materials had been made available and, after the application of first aid, research should be there to help relief. AMGOT should be followed as quickly as possible by UNRRA, and hot on their heels should come "HUHO, Help Us to Help Ourselves".

COAGULATION OF COLLOIDS

By Prof. ERIC K. RIDEAL, M.B.E., F.R.S.

IN his presidential address delivered to the Chemistry Section of the Indian Science Congress last January, Prof. S. S. Joshi, of the Benares Hindu University, discussed *inter alia* various aspects of the kinetics of colloid systems.

In dealing with molecular reactions in solution, three methods of attack have yielded interesting and important results; one based upon gas kinetic concepts, the second on the Einstein diffusion equations and, finally, the transition state method of approach. In reactions between colloid particles or macromolecules, the second method of approach is generally employed and we are indebted to Smoluchowski for formulating the general principles.

The rates of coagulation are arbitrarily divided into rapid and slow rates respectively, the latter being derived from the former by the introduction of a factor ξ giving the fraction of collisions which are 'successful'. Since the rate of coagulation falls as particle charge rises, the potential barrier due to the diffuse layer of ions around the particles (the zeta potential ζ) can be regarded in the light of a potential barrier to be overcome for successful collision; we would thus anticipate that an equation of the type

$$\log \xi = \frac{K\zeta}{RT} + C$$

should connect the collision factor ξ with the zeta potential ζ. This is true for certain cases. We have found it to hold for quartz covered with gliadin, but in many cases the rate of coagulation is independent of ζ over a considerable range. Wiegner, Tuorila and Müller have shown that Smoluchowski's equations can be applied with considerable success to the problem of coagulation of uncharged particles, and extended the work to anisodimensional particles and more particularly to polydisperse systems. In the latter case it was shown that if the system were in motion the larger particles would 'strain out' the smaller ones. We might anticipate that the walls of the containing vessel would serve as collectors to neutral colloid particles undergoing auto-coagulation if the suspension was kept agitated. Prof. Joshi cites many cases of the effect of the containing vessel on the coagulation rates of sols, and makes the important observation that it is not necessary that the wall should have a zeta potential opposite in sign to that of the colloid.

Prof. Joshi rightly directs attention to the fact that the kinetics of coagulation do not obey the simple theory. The work of Levine in Great Britain and of the Amsterdam school of investigators has shown that for charged particles a position of minimum potential energy can be found in which the particles are a finite distance apart. We might thus expect to find doublets present in solution, which would require a definite energy of activation before they underwent true coagulation or coalescence; here the coagulation-rate would be pseudo-unimolecular. Another difficulty, which was first emphasized by Haber, is that the particles on coalescence undergo the phenomenon of 'ageing', resulting in a change of size and consequently a change in the diffusion coefficient on which the kinetics of coagulation are dependent. This ageing process, which can be followed in many cases by means of X-rays or by the rate of liberation of absorbed emanation or dyes, is virtually a process of recrystallization and proceeds most rapidly in heteropolar systems such as colloidal sodium chloride, and much more slowly in colloids such as the hydrous oxides or sulphides.

The most satisfactory method of determining the rate of coagulation of a colloidal solution is by direct observation with the aid of an ultra-microscope. This method is eminently suitable for colloidal systems in which the refractive index of the disperse phase is markedly different from that of the dispersion medium; but where the light scattering is poor, as is the case for the proteins or hydrous oxides, many observational errors are apt to creep in. Many observers have consequently employed more indirect methods, especially the viscosity. The Benares school has made much use of refractivity measurements for this purpose.

The utilization of viscosity measurements for following the rate of coagulation may be seriously called in question. To a first approximation the viscosity of a sol, if the electroviscous effect be eliminated by the addition of an electrolyte, should, in accordance with Einstein's equation, be independent of the dispersity of the disperse phase, and only depend on its total volume. Prof. Joshi states that the viscosities of a number of dilute emulsions likewise obey the Einstein equation. This can scarcely be the case if the disperse phase has a measurable viscosity *per se*. Prof. G. I. Taylor, some years ago, evaluated the viscosity of a dilute emulsion in terms of the volume fractions and specific viscosities of the two phases, but so far as I am aware, this equation has not been subjected to any detailed experimental verification. Changes in viscosity do, however, occur in coagulation of colloidal systems, partly because the specific volume of the disperse phase changes due to dehydration, partly because a shape factor begins to emerge as the particles grow and, in some cases at least, as investigations on solutions of polymers have revealed, the larger particles may be deformable under shear and thus raise the viscosity.

It is evident that many factors enter into the problem of the kinetics of coagulation and their determination, and we are indebted to Prof. Joshi and his school at Benares for much painstaking and detailed work in this difficult experimental field. It is satisfactory to note that real progress is being made in that the factors operative are being isolated and identified.

ANGLO-PORTUGUESE SCIENTIFIC RELATIONS

By Sir GEORGE THOMSON, F.R.S.

IN view of the renewed intimacy which recent events have infused into the centuries-old association of Portugal and Great Britain, and of the prospect of increased co-operation between the two countries, there is a special significance in the publication of a study in Portuguese by Prof. H. Amorim Ferreira on Anglo-Portuguese scientific relations*. The history of science is often treated as if it were a matter of a few great names, and one is apt not to realize the importance of the part played by those whose fame was greater in their life-time than in after ages. In particular, problems of the

* Relações científicas entre Portugal e a Grã-Bretanha. Por H. Amorim Ferreira. Pp. viii+76. (Lisbon: Academia das Ciências de Lisboa, 1943.)

transmission of ideas are often a matter of exploring the movements of the less well-known workers. This is a difficult and laborious task, but essential for an understanding of the spread of scientific knowledge and the birth of ideas by the cross-fertilization of two strains of thought. Prof. Ferreira has made a most successful and detailed essay on these lines, and one may hope that this book will inspire others to similar tasks.

Without question, the greatest contribution of Portugal to science was the long series of voyages of exploration brought about by the enthusiasm and drive of Prince Henry the Navigator, who was himself a most successful example of collaboration between the two countries, for his mother was an English princess. His work broke down the scientific lethargy of the Middle Ages by making it clear that the known, even on this earth, is only a fraction of the knowable, which after all is the first condition for a vigorous school of science. But, even leaving his work aside, the relations between the countries have been extensive and varied.

Early in the list in chronological order we meet a series of Portuguese physicians who went to England in the sixteenth and seventeenth centuries, taking with them the benefits of Moorish medical science. Some of them held positions of great importance at the court and elsewhere and their experiences were sometimes more exciting than pleasant. For example, Rodrigo Lopez, who came to England in 1559, had dealings with Leicester and Essex, became chief physician to the Queen, and helped to influence her to the expedition of 1589. The failure of this and the ill-will of Essex led to his being unjustly accused of an attempt to poison the Queen in the interests of Philip of Spain. He was imprisoned, tortured and finally executed, a cruel reward for excellent work among the poor in the wards of St. Bartholomew's Hospital.

Lopez was a Jew, as were many of the Portuguese in England at this time; and later, even well into the latter half of the eighteenth century, their position in Portugal was insecure. Religious and other persecution has played a great part in the spread of scientific knowledge at many periods of the world's history, and our age has had ample experience of this example of good coming from evil. The movement between England and Portugal was not all in one direction, for a number of English Jesuits, mostly mathematicians, went to Portugal in the seventeenth century and promoted the study of their subject in that country.

The Portuguese physicians introduced the use of Peruvian bark to England, and developed a preparation of it long known as "English Water". One of the greatest of them, Castro Sarmento (1691–1762), improved this and broke with the secrecy common at the time by publishing his method of preparing it. It is interesting to note that through him the observations of the Jesuit astronomers at Pekin were transmitted to the Royal Society, an early example of inter-continental scientific relations.

During the latter two thirds of the eighteenth century the relations between Portugal and the Royal Society were very close. A great many papers of Portuguese origin were published in the *Transactions*, and a surprisingly large number of Portuguese were elected fellows, some resident in England but others not. Among the former one of the most remarkable was Bento de Moura, a man of great mechanical genius who improved Savery's steam engine in a way which earned the praise of John Smeaton. He afterwards returned to Portugal and entered the Government service, but fell foul of the then all-powerful Marquis de Pombal, and was imprisoned for five years in a fortress, where he died in 1766. Several of the correspondents of the Royal Society at this period were priests, among them Father da Serva, who helped to found the Academia Real das Ciências at Lisbon.

Towards the end of the eighteenth century, a number of students were sent from Portugal to England and Scotland to study medicine, a reversal of the tide in the previous century. Rather surprisingly, their director of studies at the Embassy was shocked at the expensive tastes of the Edinburgh students of the period.

In the nineteenth century a number of British scientific men did important work on the natural history of Portugal, and one, David Sharpe, is regarded there as the founder of Portuguese palæontology. In one case at least they received magnificent recognition, Alfred Tait being made Baron de Soutelinho for his work on phylloxera.

The contacts between Britain and the Portuguese islands have for long been especially close, and besides visiting scientific men, a number of British residents in Madeira have made valuable contributions to the natural history of the island. In another field of activity it is interesting to read that the artificial harbour of Ponta Delgrada was designed by Sir John Rennie.

The present book, which is dedicated jointly to the Academia das Ciências and the Royal Society, belongs to a series of scientific and historical works sponsored by the Academy.

PATULIN

IN a recent article[1] we referred to the remarkable bacteriostatic properties of the fungal products which have been called 'penicillin' and 'helvolic acid'. Penicillin has recently been discussed at a meeting of the Royal Society of Medicine, which is reported in the *British Medical Journal*[2] and in the *Lancet*[3]. The *British Medical Journal* devotes an annotation to it entitled "Penicillin in Tunisia". Readers who wish to know the results of trials of penicillin in North Africa and the Middle East, and also the results of other clinical trials, should consult these two articles. Helvolic acid, isolated from *Aspergillus fumigatus*, var. *Helvola*, is the subject of an annotation in the *Lancet*[4]. It is distinct from 'fumigacin', which was isolated from *Aspergillus fumigatus* by S. A. Waksman, E. S. Horning and E. L. Spencer[5]. To these must now be added 'patulin', isolated from *Penicillium patulum*. The chemical properties and use of this for the treatment of the common cold are described in the *Lancet*[6].

In Part I of this article Prof. H. Raistrick explains that for some years he and his colleagues have been studying, at the London School of Hygiene and Tropical Medicine, the metabolic products of the lower fungi. A large number of these metabolic products have been isolated in a pure form, the chemical constitution of some of them has been determined and some of them have been synthesized. Prof. Raistrick and his co-workers have studied the anti-bacterial properties of some of these substances and give references in this article to their work. Patulin is one of these. Its chemical name is anhydro-

3-hydroxymethylene-tetrahydro-γ-pyrone-2-carboxylic acid.

In Part 2 of the article Dr. J. H. Birkinshaw, Mr. A. Bracken, Dr. S. E. Michael and Prof. H. Raistrick describe in considerable detail the biochemical and chemical properties of patulin. Pure patulin is a colourless substance which crystallizes in compact prisms or plates. It has been isolated from two strains of *P. patulum*, one obtained from Holland and one obtained from condenser water.

In Part 3 of the article Dr. W. E. Gye describes how he received a sample of patulin from Prof. Raistrick for chemotherapeutic tests on cancer. Being in the second stage of a common cold, Dr. Gye douched his nasal passages with a watery solution of patulin. Within an hour his nasal passages were cleared; the douches were repeated twice with weaker solutions; a night of undisturbed sleep followed and next morning he was quite well and back at work. A later trial failed to cure the early stages of another cold, and Dr. Gye suggests that patulin may not act on the virus stage; the secondary stage of infection with Gram-positive and Gram-negative organisms was, however, completely prevented. Later he found that solutions of 1 : 20,000 of patulin were painless (the earlier solutions of at least 1 : 1,000 tried by Gye caused some pain) and colleagues and friends of Dr. Gye's tried these. One of them reported that patulin did not reduce the temperature nor shorten the duration of influenza; but it did prevent the nasal symptoms which often obscure the diagnosis of this disease. Only one of these volunteers reported no effect at all. The results obtained by the others suggested that trials under controlled conditions were warranted.

Part 4 of the article describes these trials, which were conducted on Naval personnel by Surgeon Commander W. A. Hopkins. Experimental work showed that patulin has bacteriostatic powers against a number of Gram-positive and Gram-negative aerobic organisms. Preliminary experiments have shown that it is also active against anaerobes. Commander Hopkins says that patulin differs from penicillin, gramicidin and citrinin in showing no selective differentiation between Gram-positive and Gram-negative organisms. It is very much less active than penicillin against Gram-positive organisms, but is more active than penicillin against Gram-negative ones. It is more active than penicillin against organisms of the coli-typhoid-salmonella group and against *Bact. dysenteriæ* Shiga. The *Lancet*, in its leading article entitled "Moulds and Colds"[7], points out that these comparisons are made against the impure preparations of penicillin available two years ago. Pus and serum do not affect its action. Solutions of 1 : 8,000 do not affect the phagocytic activity of leucocytes, although solutions of 1 : 2,000 inhibit it.

Patulin keeps well in a phosphate buffer at *p*H 6 and this was used for the trials. Patients in whom differential diagnosis between the common cold and influenza arose were excluded; only cases of acute or subacute rhinitis with or without pharyngitis, that is, cases of the ordinary common cold, were used. The commonest organisms found by swabbing the nasopharynx of the patients were *Strep. pneumoniæ*, *Micrococcus catarrhalis* and streptococci (alpha and beta). When solutions of patulin of from 1 : 5,000 to 1 : 20,000 were sprayed at intervals of four hours or so into the nose, or snuffed up from the hand or introduced by a pipette or gargled, 57 per cent of the patients recovered completely within forty-eight hours, while only 9·4 per cent of the controls recovered in this time. A large number were cured by the end of twenty-four hours. When five cases of influenza were treated with a 1 : 10,000 solution, the course of the disease was not influenced in any way. This confirms Gye's statement above. Some difficulty was experienced in assessing the results, because the common cold has few objective signs and the patient's statements are not always reliable. A statistical note on the results by Prof. Major Greenwood concludes the whole paper.

Commander Hopkins is wisely cautious about the conclusions to be drawn from his results. He says that the etiology of the common cold is not yet fully understood and that further extended trials are required before definite claims can be made for patulin. It would seem that extended trials on patients with pre-existing or concomitant sinusitis are especially needed, because, in some cases described by Commander Hopkins, after an apparent cure of a cold by patulin, severe sinusitis developed. The public interest in a cure for the common cold is naturally so keen that Commander Hopkins's caution is as necessary as the statement by Prof. Raistrick that patulin will not be released for general issue until further large-scale confirmatory trials have established its value and complete freedom from danger. Meanwhile the Therapeutic Research Corporation, which has helped both financially and technically in the work here described, is arranging for the manufacture of patulin in adequate quantities.

[1] NATURE, **152**, 604 (Nov. 20, 1943).
[2] *Brit. Med. J.*, 654 (Nov. 20, 1943).
[3] *Lancet*, 638 (Nov. 20, 1943).
[4] *Lancet*, 609 (Nov. 13, 1943).
[5] *J. Bact.*, **45**, 233 (1943); *Science*, **96**, 202 (1942).
[6] *Lancet*, 625 (Nov. 20, 1943).
[7] *Lancet*, 641 (Nov. 20, 1943).

OBITUARIES

Mr. E. H. Clifford

EDWARD HERBERT CLIFFORD, who died on October 11, aged sixty-seven, was a distinguished mining engineer whose name will long be remembered by his professional brethren. His career contained no spectacular incident to bring his name prominently before the general public, his *métier* being rather that of a 'back-room' boy, who nevertheless left behind him a record of solid achievement which will remain a monument to his name so long as gold and copper mining is carried on in the Transvaal and the Rhodesias.

Born in 1876, he went to St. Paul's School and commenced his technical education in 1892 under Sir Clement Le Neve Foster. Graduating as an associate of the Royal School of Mines in 1895, he spent a year at the Bergakademie, Freiberg, before going to South Africa. During his early years on the Witwatersrand he filled a number of junior posts of a varied nature both on the surface and underground in different mines, thereby laying the foundation of the wide general knowledge he ultimately accumulated. In 1899 he obtained his first executive appointment as chief surveyor at Langlaagte Deep, which now forms part of the Crown Mines. During the South African War he enlisted in the Johannesburg Mounted Rifles and saw extensive active service in the Eastern Transvaal. On demobilization he

returned to Langlaagte for a short time before being appointed chief surveyor to Rand Mines, Ltd. During 1907–11 he acted as assistant to the consultant engineer to the Eckstein Group and was given the highly responsible task of investigating and reporting on properties in various localities which were then considered 'outside' areas but are now recognized as extensions of the original Rand series. One of these was the Modder B Mine, of which he was appointed manager in September 1911 just as it came into production. The company paid its initial dividend the following year and has continued to pay annual dividends ever since. Modder B, at the time Mr. Clifford became manager, differed in many respects from the then operating mines of the Central Rand in that the gold-bearing conglomerate had a very flat angle of dip. Consequently methods of working and development differing materially from those in common use on the goldfield had to be devised. The record of the mine is an eloquent testimony to the skill and knowledge with which Mr. Clifford faced and successfully overcame the problems.

Clifford's technical ability was so widely recognized and his professional status so well established that in 1912 he was appointed consulting engineer in Johannesburg to the Central Mining and Investment Corporation, a position he held until 1923, with the exception of a period during the War of 1914–18, when he acted as chief technical adviser to the Mineral Resources Department of the Ministry of Munitions. While with the Central Mining Group he became interested in the question of deep mining, which he foresaw would become a matter of vital importance to the Witwatersrand. He gave much time and thought to the problems of deep winding and ventilation which would thus arise and pressed his views strongly on his colleagues in regard to these matters.

His experience with the Ministry of Munitions in the War of 1914–18 was invaluable to Sir William Larke and his colleagues on the Non-Ferrous Metallic Ores Committee, which was formed in 1940 to advise the Minister of Supply on the possibility of supplies from home metal mines during the War. Nobody knew better than Mr. Clifford that ample labour, time, money and patience are required to open or re-open even the smallest mine, and that, unless steps were taken quickly, nothing of any value was likely to be produced in the immediate future. He also had strong views on the necessity for reviving home metal mining on a long-term basis, and at times expressed himself forcibly on the subject.

In 1919 he returned to South Africa for a few years and, after resigning his position with the Central Mining Corporation, spent some time visiting mines in various parts of the world.

In 1926 he was appointed consulting mining engineer to the British South Africa Company, and commenced what was probably the most productive part of his professional life. Though he held no post directly responsible for the development of the great Rhodesian Copper Mines, he visited Rhodesia on behalf of the chartered company every year, where his advice was eagerly sought by the local managements, and his informed reports of great value to his colleagues in London.

Mr. Clifford's eminence as a mining engineer was recognized by the members of his profession when he was elected president of the Institution of Mining and Metallurgy in 1941, a difficult task in a difficult time, which he carried out admirably. His devotion to the Royal School of Mines was proverbial and, however busy he might be, he was always ready to advise and assist young mining engineers. He went to great trouble to find ways and means of encouraging the right type of recruit to enter the profession. He was also a governor of the Imperial College of Science and Technology, being appointed as their representative by the Royal Commissioners for the Exhibition of 1851.

Yachting was his great hobby, and, whenever his many professional duties allowed him, he turned to the *Vigilant* for recreation. She was a Thames barge converted into a comfortable cruising yacht in which, assisted by his wife, formerly Miss Jane Leck of Johannesburg, he delighted to entertain his friends. Every year he attended the barge races, flying the winning pennant won by *Vigilant* many years ago. Many of the fitments he made himself, as he was both a skilled carpenter and metal worker.

J. A. S. RITSON.

WE regret to announce the following deaths:

Mr. Clive Cuthbertson, O.B.E., F.R.S., fellow of University College, London, on November 16, aged seventy-nine.

Sir Edward Poulton, F.R.S., formerly Hope professor of zoology in the University of Oxford, on November 20, aged eighty-seven.

NEWS and VIEWS

Economic and Technical Reconstruction in Europe

THE address on "Economic and Technical Reconstruction in Central Europe" delivered by F. Nemec, Minister of the Czechoslovak Government in London, at a meeting of the Association of Austrian Engineers, Chemists and Scientific Workers on July 12 not only pays a tribute to the work of the Inter-Allied Committee on post-war requirements. It also gives an outline of the plan which that Committee has already worked out to cover the requirements for the first six months after the liberation of Europe. The Committee indeed forms an important and valuable basis for setting up the proposed United Nations Requirements and Rehabilitation Association. Mr. Nemec emphasized once more that the technique of executing and rendering speedy relief to the enemy-occupied territories leads naturally to the second task of economic rehabilitation, which is essential if the European nations and European civilization are to be saved.

The requirements of the 'master plan', Mr. Nemec indicated, are based, so far as foodstuffs are concerned, on British consumption, giving due consideration to variations in climate and to any unusually severe malnutrition as well as to differences in the general diet of the countries concerned. Animal and vegetable oils and fats are of particular importance, and a maximum consumption of 70 per cent of the pre-war consumption has been accepted for the first six post-war months, for countries like Britain where the consumption is high, and smaller restrictions for

countries with a normally lower consumption. The importance of a quick supply of fertilizers as an essential to a recovery of agriculture was stressed, and Mr. Nemec uttered a warning with regard to the timber and paper position. Requirements in respect of leather, skins and boots over the same six-month period have been calculated on the consumption under the British rationing scheme of 1941–42, and the British ration also forms the agreed basis in respect of imports of textiles. Careful attention has also been given in the plan to the consumption of crude oil and its by-products and of coal. Czechoslovakia expects to be once more in a position to export coal, of which Austria was formerly her best customer. Requirements of the non-ferrous metals, copper, lead and zinc will be great, and supplies of medicants, seeds, certain machinery such as locomotives and lorries, will be of primary importance.

Mr. Nemec said that the joint organization of the United Nations will operate on the basis of a pooling of all means of transport and unified management of the entire post-war European transport system for relief purposes. One of the basic assumptions of the Leith Ross Committee was that the aim must be the full employment of the nations concerned. Mr. Nemec referred briefly to the problems involved in the industrialization of South-Eastern Europe, in which Czechoslovakia might well help; and expressed the view that it is essential to organize import control of important raw materials now, by creating pools for the supply of essential kinds of goods for the post-war relief period and afterwards.

Twenty-One Years of Broadcasting

NOVEMBER 1943 sees the completion of twenty-one years of regular and authorized broadcasting in Great Britain, and the coming-of-age of the British Broadcasting Corporation—formerly a limited company with the same initial letters, the British Broadcasting Company, Ltd. The occasion was celebrated by a special programme on Sunday, November 14, during which Mr. John Snagge presented a series of B.B.C. reminiscences. On the following Wednesday, November 17, Mr. Stuart Hibberd, chief announcer of the B.B.C., read a paper before the Royal Society of Arts entitled "The Coming-of-Age of Broadcasting". The amazing developments which have been achieved during the growth of broadcasting in Great Britain have been due to the excellent team-work of everybody concerned—artists, programme organizers and engineers alike.

Mr. Hibberd stated that it was the general strike of 1926 which brought home to people the importance of broadcasting in a national emergency, and demonstrated the power of the spoken word. The technical achievements following that include the introduction of the Empire short-wave service in 1927, the broadcasting of the bells of Bethlehem in the Christmas programme of 1933, and of a programme by members of the Byrd Antarctic Expedition from their camp nearly 9,000 miles away in April 1934. These programmes record the attainment of successful collaboration with other organizations such as the Columbia Broadcasting System of America, while one of the greatest triumphs of the outside broadcasting organization was that of the coronation of King George VI, when the whole programme was maintained for six hours non-stop without using a studio at all. During the War, the European and overseas broadcasting services have been developed to the point at which day and night transmissions are now made almost continuously in no less than forty-five foreign languages. In his closing remarks, Mr. Hibberd directed attention to the possibilities of the future; and among these was a plea for a post-war university of the air, by means of which students could be placed in touch with the greatest authorities on their subjects in the land.

Indian Association for the Cultivation of Science

THE annual report of the Indian Association for the Cultivation of Science for the year 1942 includes the presidential address of Sir U. N. Brahmachari, the report of the Committee of Management and a list of papers appearing during the year in the six issues of the *Indian Journal of Physics* and *Proceedings of the Indian Association for the Cultivation of Science*. Sir U. N. Brahmachari, referring to the beginnings of the Association, quotes from the sketch of the original scheme given by Mahendra Lal Sircar on December 16, 1875, indicating that the founder had in mind an institution combining the scope, character and object of the Royal Institution in London and the British Association for the Advancement of Science. Dr. Sircar hoped to see it develop into an institution where his countrymen, after finishing their university education, would on their own account carry out original research in the different branches of science. When the scheme had reached maturity, another scheme for a technical institution was launched by the Indian League, and it was only after some controversy that a decision was reached not to amalgamate the schemes, and the Association was inaugurated on July 29, 1876.

Sir U. N. Brahmachari then discusses the future of the Indian Association, and refers to the proposal to create a new body of members to be called 'fellows' in recognition of distinguished research work conducted by them. The number of life-members has increased by 17 since 1942 and of ordinary members by 60. It was proposed to remove the Institute to a place nearer a seat of scientific learning, to renovate the chemical laboratory and create a fellowship, and ultimately a professorship, in the name of Sir P. C. Ray. The Department of Chemistry proposes to take up the study of some of the more important problems in industrial chemistry, and an approach to the Governments of India and Bengal, the Board of Scientific and Industrial Research and the Rockefeller Foundation might be desirable. In addition to research, however, it is proposed to undertake the propagation of science, for example, by means of a series of lectures by men of the eminence of Sir J. C. Bose, Sir C. V. Raman, Dr. F. W. Aston and others, as well as to continue the present arrangements for research by postgraduate students for the doctorates of various universities. The president also suggested regular meetings for the discussion of scientific subjects by the research workers of the Association, and full co-operation with the University College of Science, Calcutta, the Bose Institute and the science departments of the Colleges affiliated to the University of Calcutta, as well as the Calcutta School of Tropical Medicine and the All India Institute of Hygiene.

Absenteeism among Women

EMERGENCY REPORT No. 4 of the Industrial Health Research Board (H.M. Stationery Office, 1943. 2*d*.) gives a study of absenteeism among women for the period 1942. It is concerned with the amount and distribution of absenteeism among women rather

than with the causes. Random samples of workers in factories were studied for periods of six weeks, at times of the year which were not affected by leave or annual holidays. The women worked on the three-shift system and the shifts were changed weekly. Analysis of the figures showed that, contrary to the general view, few women habitually lost one or more shifts each week, but a large majority were absent for varying lengths of time at irregular intervals. This suggests a study of the personal causes of absenteeism. Much of the absence was due to full-week absence and this was mainly due to sickness. Married women lost more time than single women, and they also tended to have more longer and fewer shorter absences than single women. Absenteeism was highest on Saturday, and was lowest on pay-day. A factory that employed a very large number of women, and which had grown very rapidly and was situated in an isolated position, had a higher absence rate than one of more stable development and more advantageously placed. On the average it was found that there was little difference in absenteeism between women who took up to one hour to reach the factory, but above that limit absenteeism increased with travelling time.

Bicentenary of Martin H. Klaproth (1743-1817)

BORN on December 1, 1743, a few months after Lavoisier, Martin Heinrich Klaproth was the foremost chemist in Germany, and it was largely due to him that his fellow-workers in Berlin adopted the new theories of the French chemists in place of the phlogiston theory of their countryman Stahl. Klaproth was born in the small town of Wernigerode, in Upper Saxony. He was educated first for the Church. He began his life's work as an assistant in a laboratory at Quedlinburg, where he spent seven years. After short periods passed in Hanover and Dantzig, he entered the service at Berlin of the elder Valentin Rose (1736–71), the grandfather of the well-known chemists, Heinrich and Gustav Rose. His employer's early death in 1771 led him to set up a laboratory of his own and he afterwards gained a high reputation for his numerous and accurate analyses of minerals. His researches were regarded as a pattern for the rising generation of chemists, and to him we owe much of the early known facts about zirconium, uranium, tellurium, cerium, titanium and beryllium. He also prepared a mineralogical system, and with Friedrich Benjamin Wolf published the first German chemical dictionary. He held various public appointments; in 1788 he was elected a member of the Berlin Academy of Sciences, and when the University of Berlin was founded in 1809 by Wilhelm Baron von Humboldt, Klaproth was given the chair of chemistry. As a member of the Academy, he had in 1792 repeated the most important experiments of Lavoisier, and it was this that contributed to the spread of the new theories. He kept active to the last and died in Berlin on January 1, 1817, at the age of seventy-three. His son, Heinrich Julius von Klaproth (1783–1835), was a distinguished Orientalist and traveller.

Science Class Lecture Cine-Films

A VERY successful film exhibiting the Brownian movement has recently been made in the Natural Philosophy Laboratory of the Royal Technical College, Glasgow, by Mr. Thomas S. Wylie, a former student of the College, in collaboration with Dr. Quintin Moore, of the Bacteriology Department. A dilute aqueous suspension of colloidal silver particles of order 50 mμ (50×10^{-7} cm.) diameter was viewed with the aid of a 'Cardioid' ultra-microscopic condenser in conjunction with a microscopic combination magnifying about 1,200 times. The film was photographed through the eyepiece of the microscope. This is an excellent example of a really useful application of cine-photography to the experimental illustration of a science class lecture. In order that the students of a large class can observe individually the Brownian movement under the microscope, it is necessary to have the apparatus set up on many successive meetings of the class. With this film the whole class can observe the motions in a matter of three or four minutes. Mr. Wylie has also made an interesting film which, in a time of about ten minutes, shows the following surface tension experiments, some of which are difficult to set up and manipulate: (*a*) formation of a drop with the subsequent Plateau's spherule; (*b*) camphor movements on a clean water surface; (*c*) the beating 'mercury heart'; and (*d*) the difference in pressure in large and small bubbles.

Do All Statements Make Predictions?

IN the July issue of *Mind*, Mr. John Wisdom, under the title of "Other Minds (VII)", continues his lengthy philosophical dialogue dealing with our knowledge of other minds. In this episode his three interlocutors, Black, White and Gray, expound in that strange, obscure, slang-ridden, ungrammatical English which Mr. Wisdom affects, a theme which merits the attention of all interested in the problems of epistemology. The theme is simple: "what makes a statement objective also makes it predictive". It would be impossible in a few words to review the subtle analysis, the fine distinctions, which emerge from Mr. Wisdom's variations on this theme. Every kind of statement which might claim merely to report present fact and not to predict anything is brought to the bar and convicted of lurking predictiveness. The knowledge expressed in the statement "I am in pain" is finally admitted to be not predictive, but it is alleged to be a queer kind of knowledge because we cannot conceive what it would be to be wrong on such a matter. Again, speaking of statements such as "All men are mortal" the author says: "They become more really knowable, more necessarily true, the fewer future facts can make them fail, and they become quite knowable and quite necessarily true only when no future fact can make them fail". This is what America's greatest philosopher, Charles Sanders Peirce, said forty years ago. It has not ceased to be true, and Mr. Wisdom embroiders its expression with many illuminating subtleties of thought.

Some Old Letters of Astronomical Interest

IN an article entitled "An Eighteenth Century Correspondence" in the October issue of the *Observatory* (65, 92; 1943), Prof. H. C. Plummer reports on the contents of a collection of old letters received by Nathaniel Pigott and lately presented to the Royal Astronomical Society. Nathaniel (*c.* 1740–1804) was the father of Edward Pigott, who discovered the variability of η Aquilæ. He was himself greatly interested in astronomy, making observations of a partial eclipse of the sun in 1765 and of the transit

of Venus in 1769. He was elected a fellow of the Royal Society in 1772, and spent five months in the Low Countries in survey work. Five years later he made his home at Frampton, Glamorgan, where he equipped a private observatory with a transit instrument by Sisson, a 6-ft. achromatic telescope by Dollond, and other instruments. He lived in the heyday of the professional instrument maker, and such men as Bird, Peter Dollond and Sisson figure among his correspondents in this collection. Distinguished members of the Paris Academy of Sciences, of which he was elected a corresponding member in 1776, also corresponded with him, and the collection includes letters from Lacaille, Messier, Le Monnier and others. Among English astronomers whose letters to Pigott are preserved, Maskelyne and Hornsby are perhaps best known. At present, of course, the question of printing the collection cannot be contemplated; but the Royal Astronomical Society intends to preserve the correspondence carefully until such time as a selection, at least, of the letters can be published.

Earthquakes Recorded during July and August

BETWEEN July 4 and 31 inclusive thirteen strong earthquakes were registered at Kew, the strongest being apparently on July 29. This came from an epicentre 6,770 km. distant bearing an azimuth 270° from Kew, and attaining at Kew an amplitude of 870 μ. Other strong shocks were on July 11, registered at 02h. 30m. 14s. U.T. with maximum amplitude 45 μ from 17,700 km., and on July 23 registered at 15h. 07m. 28s. U.T. with maximum amplitude 87 μ from 12,200 km. At Wellington, New Zealand, earthquakes registered on July 11 at *ca.* 02h. 12m. 37s. from an epicentre at lat. 33° S. long. 177° W., and on July 23 at 15h. 03m. 45s. from an epicentre distant *ca.* 66°. During July in New Zealand there were nine locally felt earthquakes, the greatest being on July 10 in upper Takaka with Mercalli scale strength IV, on July 23 at Masterton with Mercalli scale strength III, and on July 28 from Christchurch to Timaru with Mercalli scale strength III.

In August there were five strong earthquakes recorded at Kew and twenty at Toledo. Those in common were August 2, Kew 01h. 06m. 39s., Toledo 01h. 06m. 38s., distance from Kew 19,000 km. and from Toledo 19,300 km.; August 10, Kew 15h. 24m. 48s., distance 8,100 km.; Aug. 12, Kew 05h. 03m. 14s., Toledo 05h. 04m. 06s., distance from Kew 9,300 km. and from Toledo 11,180 km.; and August 13, Kew 07h. 47m. 05s., Toledo 07h. 45m. 29s., distance from Kew 6,200 km. and from Toledo 5,100 km. The United States Coast and Geodetic Survey has determined the epicentre of an earthquake on August 31, this being lat. 13½° N. long. 91½° W., which is in the Pacific Ocean just off the south-west coast of Guatemala in Central America. Time at origin was 16h. 10·5m.

The Night Sky in December

FULL moon occurs on Dec. 11d. 16h. 24m. U.T., and new moon on Dec. 27d. 15h. 23m. The following conjunctions with the moon take place: Dec. 11d. 00h., Mars 7° N.; Dec. 12d. 01h., Saturn 2° N.; Dec. 17d. 07h., Jupiter 0·8° S.; Dec. 23d. 19h., Venus 3° S.; Dec. 18d. 13h., Mercury 2° S. The following occultations of stars brighter than magnitude 6 take place: Dec. 4d. 18h. 09·5m., ψ Aqr. (*D*); Dec. 13d. 00h. 51·4m., ν Gem. (*D*); Dec. 13d. 02h. 05·3m., ν Gem. (*R*); Dec. 24d. 06h. 19·2m., γ Lib. (*D*). The times refer to Greenwich and *D* and *R* refer to disappearance and reappearance respectively. Mercury sets 20 minutes after the sun at the beginning of the month, and about an hour later than the sun in the middle of the month. It attains its greatest easterly elongation on Dec. 23 and on Dec. 30 is stationary. At the end of the month Mercury sets at 17h. 15m. Venus, a morning star, rises at 3h. 22m., 3h. 53m. and 4h. 34m. at the beginning, middle and end of the month respectively. Mars, in the constellation of Taurus, can be seen through most of the night, rising early in the evening and setting in the morning at 8h. 36m., 7h. 11m. and 5h. 49m. at the beginning, middle and end of the month. The planet is in opposition on Dec. 5. Jupiter, in the constellation of Leo, can be seen late at night, rising at 22h. 11m., 21h. 17m., and 20h. 12m. at the beginning, middle and end of the month respectively. Saturn is near Mars but sets later in the morning. In addition to the above phenomena, Jupiter will be occulted by the moon on Dec. 17d. 07h. 18·6m., reappearing at 8h. 14·9m. Winter solstice commences on Dec. 22d. 17h. The Geminid meteors are active during Dec. 1–12, emanating from different radiants in the constellation of Geminus.

Announcements

LIEUT.-COLONEL EDGAR PAM, consulting engineer to, and deputy delegate director of, the Mond Nickel Company, Ltd., has been elected president of the Institution of Mining and Metallurgy for the session 1944–45.

THE Institution of Mechanical Engineers announces that, thanks to arrangements made by the War Organisation of the British Red Cross and the Order of St. John of Jerusalem, 37 candidates recently sat for the Institution's examinations in prisoner-of-war camps in Germany. No fewer than 34 (92 per cent) passed with an exceptionally high average percentage marking. The results reflect credit both on the candidates and on members of the Institution and others in the camps who organized classes and acted as instructors.

THE following appointments have been made in the Colonial Service: D. J. Cowan to be agricultural officer, Uganda; A. Storrar to be agricultural officer, Kenya; T. P. Weldon to be agricultural officer, Sierra Leone; M. J. Fitzpatrick to be veterinary research officer, Kenya; G. Q. Fowler to be veterinary officer, Nyasaland; P. D. L. Guilbride to be veterinary officer, Northern Rhodesia; G. W. G. Briggs (agricultural officer, Nigeria) to be senior agricultural officer, Nigeria; J. W. Wallace (agricultural officer, Nigeria) to be senior agricultural officer, Nigeria; F. S. Collier (senior assistant conservator of forests, Nigeria) to be conservator of forests, Nigeria.

DR. J. D. ROLLESTON writes: Dr. John Fulton has directed my attention to an error in my obituary of Dr. A. C. Klebs in NATURE of September 4, p. 269. The bibliography of Harvey Cushing was prepared by the Harvey Cushing Society, not by Klebs. Dr. Fulton was the compiler, but the work was principally done by Louise Eisenhardt and Miss Madeline Stanton, Dr. Cushing's former secretary.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Molecular Weight of Native Cellulose

THE molecular weight of cellulose is of great interest to cellulose chemistry, and many attempts have been made to determine it. The cellulose derivatives, esters and ethers, can in general be dissolved in simple organic solvents, and their molecular weights determined by the osmotic pressure method. It is questionable, however, if the derivatives can be prepared without degradation of the cellulose molecule. Therefore the study of cellulose in cuprammonium solutions is of very great interest. It has never been possible to carry out osmotic measurements of these solutions, owing to their high vapour pressure and the difficulties of membrane materials. Staudinger[1] has extrapolated his 'viscosity rule' from measurements of relatively low molecular weight materials and obtained degrees of polymerization of 2,000–3,000 for native cotton and ramie. Sedimentation equilibrium measurements were performed by Kraemer[2], who obtained values up to 1,300 for purified cotton linters, and estimated the molecular weight of native cellulose to be at least 570,000 (D.P. 3,500). Later, Mosimann[3] showed that sedimentation equilibrium experiments with filament molecules (nitrocelluloses) of very high molecular weights give doubtful results owing to swelling-pressure effects.

We have measured the sedimentation and diffusion velocities of different celluloses in cuprammonium solution. The complexity of the solution and the thread-like shape of the cellulose molecules make the measurements difficult. In order to achieve reliable results it is necessary to extrapolate sedimentation and diffusion measurements to zero concentration of cellulose. Both sedimentation and diffusion of these highly asymmetrical molecules are strongly affected by concentration. On dilution, the sedimentation velocity increases and the diffusion velocity decreases. The sedimentation velocity at free sedimentation (zero concentration) may be graphically extrapolated. By experience it has been found that the concentration function obeys approximately the formula

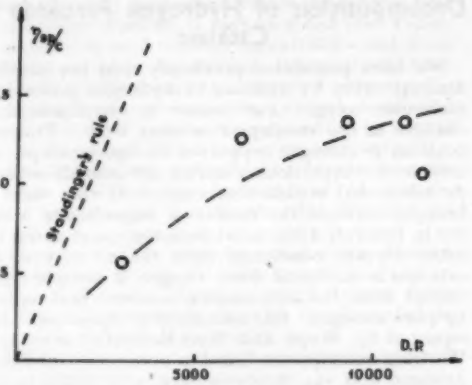
$$s = \frac{s_0}{1 + kc},$$

where s is the sedimentation constant determined at the concentration c, k is a constant and s_0 is the sedimentation constant at complete dilution. The diffusion constant at zero concentration may be determined from a single experiment by using the Boltzmann equation[4]. The diffusion constant has been found to be almost linearly dependent on concentration.

For calculation of molecular weights the formula

$$M = \frac{RTs}{D(1 - V\rho)}$$

(Svedberg[5]) has been used. This formula is independent of the shape of the molecules. The partial specific volume V of cellulose in cuprammonium solution was determined by Stamm[6] to be 0·642. Refractive index measurements have made it very probable that one copper atom is bound to every glucose unit. The cellulose copper complex has a lower specific volume than pure cellulose, and by taking the copper ion radius into consideration it was calculated to be 0·485.



All experiments were performed in a purified nitrogen atmosphere, and special arrangements were made for complete exclusion of air when filling centrifuge and diffusion cells. The results for different celluloses are given in the accompanying table.

Cellulose	$s_{c=0}$	$D_{c=0}$	M (cellulose)	$D.P.$
Unbleached cotton linters	10·7	0·23	$1·50 \times 10^5$	9,200
Raw Georgia cotton	10·4	0·33	1·00	6,200
Nettle fibre cellulose	13·7	0·25	1·76	10,800
Ramie	10·3	0·18	1·84	11,300
Sulphite wood pulp	6·2	0·43	0·46	2,900

The sedimentation constants are given in Svedberg units (10^{-13} cm./sec. dyne), the diffusion constants in units of 10^{-7} cm.²/sec.

It will be noticed that the molecular weights reported here are appreciably higher than those earlier reported for cellulose. For comparison, viscosity measurements were made. The results are given in the accompanying diagram. From this it is obvious that our results do not correspond to Staudinger's hypothesis of a linear relation between relative viscosity and molecular weight. At least for these giant molecules, the molecular weight increases very much faster than viscosity. From the sedimentation data it can also be deduced that the longer the molecules are, the more do they tend to become curled.

The free native celluloses in seed hairs and bast fibres have larger molecules than the prepared wood pulp. If wood is treated directly with cuprammonium, some of the cellulose goes into solution, and its sedimentation constant is about 8, suggesting a $D.P.$ about 5,000.

The investigations are in progress, and full details will be published elsewhere. Financial support has been received from the Royal Swedish Institute for Engineering Research, the Rockefeller Foundation and the Wallenberg Foundation.

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Decomposition of Hydrogen Peroxide by Catalase

WE have postulated previously that the catalytic decomposition by catalase of hydrogen peroxide to molecular oxygen and water is accompanied by changes in the valency of catalase iron[1]. This supposition is strongly supported by spectroscopic and manometric experiments carried out on azide-catalase. As additional evidence in support of this view, we brought forward the results of experiments carried out in Barcroft differential manometers, showing that under certain conditions even the activity of free catalase is inhibited when oxygen is completely removed from the surrounding medium and replaced by pure nitrogen. Our manometric experiments were repeated by Weiss and Weil-Malherbe[2] who, using Warburg manometers, failed to obtain this inhibition. Johnson and van Schouvenburg[3] also failed to confirm our results using luminescent bacteria as indicators of decomposition of hydrogen peroxide by catalase in complete absence of oxygen. However, we repeated our experiments from time to time, using different enzyme preparations, and invariably confirmed our previous results. The failure by other workers to obtain similar inhibition was explained by us[4,5] as being due probably either to some difficulty in complete elimination of oxygen from Warburg manometers or to some defects in their enzyme preparations.

However, two considerations induced us to reinvestigate the whole problem: (1) the ease with which our experiments were confirmed in our laboratory by Dr. H. Laser, who used for this purpose ordinary Warburg manometers; and (2) a private communication from Dr. Dickens informing us that he was completely satisfied with the experiments by Weiss and Weil-Malherbe carried out in his laboratory.

After a careful analysis of every step of our manipulation, special attention was paid to the nitrogen used in our experiments, with the view of detecting in it some impurities which could be responsible for the effects we invariably obtained.

The nitrogen in our experiments was purified by passage through a combustion tube filled with wire-form copper oxide reduced *in situ* with hydrogen and heated to redness in an electric furnace. The view that our purified nitrogen contained traces of impurities such as oxides of nitrogen was confirmed in various ways which can be summarized as follows:

(1) Incubation of a very dilute enzyme preparation with nitrogen purified as shown above, followed by evacuation and refilling the Barcroft manometers with air before mixing the enzyme with peroxide, already had a strong inhibitory effect upon the enzyme.

(2) The nitrogen from the furnace bubbled through sulphanilic acid–α-naphthylamine reagent at the rate of 100 ml. per minute for 20 minutes, together with a stream of oxygen, gave a positive colour reaction corresponding to 2 μgm. sodium nitrite.

(3) We have shown previously[6] that catalase combines with nitric oxide forming a well-defined compound.

(4) Decomposition of hydrogen peroxide in air by catalase is strongly inhibited by sodium nitrite in a concentration about ten times higher than those which could be detected in our experimental flasks, assuming that, in these flasks, 100 ml. of nitrogen comes into contact with our dilute enzyme preparations. On the other hand, the diazo reaction may be incomplete under these conditions.

(5) At the conclusion of all experiments in which inhibition was obtained, the liquid in the flask gave a positive brucine test for $-NO_3$.

(6) Passing the purified nitrogen to the manometers via a charcoal trap completely abolished the inhibitory effect of nitrogen.

(7) On lowering the temperature of the furnace so that within the combustion tube it reached only 400° C. and near the outlet somewhat lower, the inhibitory effect due to nitrogen together with the reaction for the oxides of nitrogen were completely abolished.

These experiments clearly demonstrate that the inhibition of catalase activity ascribed previously to the absence of oxygen was due to traces of some oxides of nitrogen formed during the purification of nitrogen owing to the high temperature of the furnace. It is interesting to note that out of many enzymes tested with this 'purified' nitrogen, so far only catalase, perhaps on account of high dilutions, seems to be affected by such minute traces of impurities. These results, as will be shown separately, do not invalidate our view that the catalytic decomposition of hydrogen peroxide by catalase is accompanied by reversible changes in the valency of its iron; a view shared by several other workers[7,8,9]. They only show that conditions have not yet been found for the detection of the ferrous state of free catalase during its activity owing to its much too rapid re-oxidation.

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Mechanism of the Butanol-Acetone Fermentation

THE mechanism of sugar breakdown in alcoholic fermentation by yeast, lactic acid fermentation by lactic acid bacteria and glycolysis by animal tissues has been elucidated, but the intermediate steps of the butanol-acetone fermentation are not yet known. The main problem, the transformation of C_6-compounds into C_4-compounds (like butyric acid or butanol), has not yet been solved. Two facts indicate that this fermentation follows a different scheme: (1) the normal C_3-compounds, which are doubtlessly intermediate products in the other fermentations, do *not* yield C_4-compounds; (2) *pentoses* cannot be fermented by yeast whereas they are fermented by action of butyric organisms to the *same* C_4 products as are obtained starting with C_6-compounds. As method of approach to this problem a systematic research on the *structural conditions of the substrate molecule* leading to C_4-compounds through the bacterial enzymes has been carried out in continuation of previous experiments[1].

All experiments were made with a strain of *Clostridium acetobutylicum* (Weizmann). The same results were obtained with fresh bacteria (centrifuged after 24 hr., fermentation in 1 per cent maize mash, washed three times with physiological saline solution, suspended in phosphate buffer *p*H 6·2) as with acetone-dried bacterial preparations, which showed undiminished activity for at least one year. For analytical reasons only butyric acid was determined as essential C_4-product.

The C_1-atom of C_6-compounds does not play any part in the formation of C_4-products. Replacing the CHO-group of glucose by the COOH-group (gluconic acid), by the CH_2OH-group (mannitol, sorbitol) by introduction of phosphoric acid (hexose-*l*-monophosphate, Cori-ester), butyric acid was in all cases formed. On the other hand, replacing the CH_2OH-group at C_6 by the COOH group (galacturonic acid), only acetic acid was obtained. Introducing phosphoric acid at C_6 (hexose-6-monophosphate, Neuberg-ester), only traces of butyric acid were formed. Using hexose-1,6-diphosphate (Harden-Young ester), only acetic acid was formed. Simultaneously, after some hours incubation, already appreciable amounts of methylglyoxal were observed. In this special case the sugar is therefore split into C_3-molecules.

Experiments with C_5-compounds showed, like hexoses, formation of C_4-compounds from *l*-arabinose and *l*-xylose. *d*-Arabinose was not attacked, but the corresponding *d*-arabitol formed C_4-products. *l*-Rhamnose gave also butyric acid. The C_4-compound erythritol was not decomposed by the bacteria.

The most important step was the investigation of the C_3-compounds. Phosphoglyceric acid, phosphoglyceric acid + glycerophosphate, *d,l*-glycerinaldehyde were not attacked at all; the latter even inhibited the fermentation of glucose. Pyruvic acid formed only pure acetic acid. Even in the presence of glucose, pyruvic acid formed *only* acetic acid.

Substrate	355·1 mgm. glucose	169·2 mgm. glucose 186·4 mgm. pyruvic acid	367·4 mgm. pyruvic acid
N/10 volatile acids (c.c.)	16·54	29·50	44·96
Ratio butyric/acetic acid	1 : 1	1 : 6	pure acetic acid
Butyric acid (mgm.)	72·78	37·08	

From these experiments it is concluded that pyruvic acid cannot be considered as an intermediate product for the formation of C_4-compounds. Davies and Stephenson[3] claim that butyric acid is formed from pyruvic acid. However, this result is in contradiction to my investigations. Koepsell and Johnson[3] recently published experiments with a cell-free water extract from cells of *Clostridium butyricum*. They obtained from pyruvic acid only acetic acid, carbon dioxide and hydrogen. The fact that this extract catalyses the evolution of gas from pyruvic acid but *not* from glucose forms a further proof for the view that the breakdown of pyruvic acid is *not* linked with the formation of C_4-compounds.

One single compound from the C_3-series yielded butyric acid, namely, glycerol. This shows that the formation of butyric acid must be a synthetic process, glycerol being condensed probably to a C_6-compound. It may be supposed that this condensation leads to a C_6-alcohol like mannitol and not to a C_6-sugar, as in experiments with alcohols (mannitol, sorbitol, arabitol, glycerol) the highest values for butyric acid were obtained. Further, it may be noted that Yamasaki and Simomura[4] isolated mannitol formed from glycerol by action of Aspergillus. It has already been established by Neuberg[5] and Iwasaki[6] that the C_3-compound dihydroxyacetone is not directly fermented by yeast but after previous condensation to hexose which could be isolated as hexose-monophosphate.

Glycolaldehyde was not attacked by the bacteria and even inhibited the fermentation of glucose. Sodium formate was not decomposed but had no toxic effect.

Conclusions: The obvious assumption that a similar enzyme system to that known to exist in yeast or lactic acid bacteria, which breaks down sugar into C_3-compounds, has to be discarded in favour of a different mechanism.

A detailed description of the experimental material will be published shortly elsewhere.

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Specific Diagnosis of Typhus Fever by Rickettsial Agglutination

IN a series of publications[1], we presented data demonstrating that guinea pigs, rabbits and monkeys can be immunized with formolized tissue cultures of Rickettsia and that the murine, flea-borne and human louse-borne strains were antigenically distinctive, each failing to produce immunity towards the other. The latter findings were confirmed by Zinsser and Castaneda[2]. Recently Plotz[3] confirmed the antigenic difference between murine and human strains of Rickettsia by the complement fixation method.

Since the Weil-Felix reaction, based as it is on the presence of a common antigen, does not differentiate between the two forms of typhus, we tried to ascertain whether specific Rickettsial agglutination can serve this purpose satisfactorily. Such a specific diagnostic test is of special importance for epidemiological reasons, in a country such as Palestine, where murine typhus is endemic and where the invasion of epidemic or louse-borne typhus is imminent.

The results presented below show that the two types of Rickettsia are antigenically distinct, thus confirming the previous immunological findings. They also indicate that Rickettsial agglutination can be used for early differential diagnosis of the type of infection. The data are admittedly limited, but because of the urgency of such a test it was thought desirable to report our findings at this time.

Alcoholized, formolized and untreated, purified suspensions of Rickettsia in buffered saline (*p*H 7·4) were used. The suspensions were prepared from yolk-sack cultures and standardized at a density giving clear agglutination. The organisms were added to various dilutions of serum in buffered saline, in the usual manner, and readings made after four hours in a water bath kept at 42° C., and again

Table 1.

Type of disease	Day of disease	Weil-Felix, max. titre	Murine strain, max. titre	Human strain, max. titre
Murine	5th	1 : 100—	1 : 100+	1 : 50—
	10th	1 : 200+	1 : 200+	1 : 50—
	16th	1 : 800+	1 : 400+	1 : 50—
Human	6th	1 : 100+	1 : 100+	1 : 200+
	10th	1 : 200±	1 : 100+	1 : 800±
	16th	1 : 200+	1 : 100+	1 : 800+

after 18 hours at room temperature. We used two murine strains—one from Tunis (*T*) and one from Palestine (*K*); and three human strains—a local strain isolated from lice (*L*), a louse strain from Addis Ababa (*A*), and a strain isolated from a patient who came from the U.S.S.R. (*R*).

In six confirmed cases of murine typhus (either laboratory infections or by animal inoculations), during the second week of the disease, the range of the Weil-Felix titres was 100–1,000, that with murine strains 250–400 and with the epidemic strains 0–100. In six confirmed cases of epidemic or human typhus, about the end of the first or beginning of the second week of the disease, the range of the Weil-Felix reaction was 0–200, the titre with epidemic strains 80–600, and that with the murine strains, 0–100.

In twelve additional cases from a group known to be louse-infected, the agglutination titres with human Rickettsia antigens were as follows: 4–1 : 80; 5–1 : 160; 3–1 : 320.

The course of appearance of agglutinins in two typical cases of typhus, one murine and one human, is given in Table 1.

Only one serum of those tested thus far, a Palestinian patient, gave an equally high titre, 1 : 640, with both murine and epidemic strains. The significance of such a divergent result can only be ascertained when a large series of confirmed cases has been tested.

The specificity of these reactions was substantiated in two series of animal tests, as well as by the agglutinin absorption technique. The sera of guinea pigs, which recovered from an infection with blood from patients or with known human or rat strains, were titrated against both types of organisms three to four weeks after recovery. Of six animals which passed a typical rat-type infection, the range of titre of the sera with the murine antigens was 200–80, while that with human strains was 0–100 (murine, 2–200; 2–300; 1–400; 1–800; human, 1–0; 2–20; 1–50; 2–100). Of nine guinea pigs which passed a typical human strain infection, the serum titres with the louse strains were 200–800; (2–200; 6–400; 1–800), while those with the rat strains were 50–100 (6–50; 3–100).

Table 2.

Sera	Antigens: Murine *K*	Murine *T*	Human *A*	Human *R*	Human *L*	Weil-Felix
Murine						
K 1	200+	200+	100+	100±		
2	400+	200+	200±	100±		
3	800+	400+	200+	200±	50+	50+
T 1	100+	200+	50+	50+		
2	200+	800±	100+	50+		
3	200+	800+	100+	50+	100±	100+
Human						
A 1	50—	50—	100±	50±		
2	100±	100+	400±	100±		
3	100±	100+	800+	200+	400±	100+
R 1	50—	50—	50—	50+		
2	50+	100+	200+	600±		
3	100±	100+	200+	800+	400±	200±

Finally, rabbits were immunized with formolized vaccines of four specific strains, two murine and two human, and the cross-agglutination of their sera with the homologous and heterologous strains determined. The sera of none of these animals gave Rickettsia agglutination before the injections. Three injections were given at intervals of one week and blood was taken before the second and third injections, and two weeks after the last injection. The titres of the various sera with the homologous and heterologous antigens are given in Table 2.

These results show that the various Rickettsial strains tested fall into two types or varieties. The strains of the murine type are closer to one another than they are to the human strains, and vice versa. On the other hand, it should be noted that the strains of the various type are not identical but show individual antigenic patterns.

Absorption tests substantiate these results. One murine (*K*), and one epidemic serum (*A*), was absorbed with the heterologous strains and the titres of the absorbed sera for all strains determined. The results are shown in Table 3.

Table 3.

	Titre against antigens: Murine *K*	Murine *T*	Human *A*	Human *R*	Human *L*
Serum *A* (human strain) absorbed with strains					
T	50	0	600	200	200±
R	100	50	400	0	100
A (control)	200	100	800	200	200
Serum *K* (murine strain) absorbed with					
T	200	0	100	200	50
R	200	100	100	0	0
K (control)	800	400	200	200	50

It seems, therefore, that the Rickettsias have diverse antigenic patterns with gradations between the various strains. It appears that along with the distinctive characters of the broad variants, the strains within the group show considerable antigenic overlapping and differentiation. The significant finding is that different strains of a given type have different antigenic elements. These findings have a bearing on the nature and efficacy of prophylactic vaccines. It is evident that, for the time being at least, and until the ideal strains are found, a polyvalent vaccine is called for. No single strain of a given type can be assumed to give full protection against another from a different source.

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Colour of Red Blood Corpuscles

I HAVE read with great interest recent communications on this subject which have appeared in NATURE[1]. I agree entirely with them, but another factor is, I think, involved, for when single red blood cells are looked at under a microscope they appear to be chrome yellow, lemon (barium) yellow or yellowish-green (crude auriolin) according to circumstances, whereas very dilute solutions of hæmoglobin look pale orange, beige or straw-coloured (yellow ochre) according to circumstances. In other words, there seems to be a greenish tinge visible in the cells which is absent from the dilute solution. Now, it is very easy for the eye to be misled in judging shades of colour when they are seen separately. Judgment is much more exact when the colours to be compared are seen side by side. This can be achieved in the following way.

Remove the eyepiece from an ordinary microscope. Unscrew the lenses and place them together so that they form a Ramsden eyepiece. Prick the finger and dilute the blood about 1 in 100 with normal saline. Place a drop of the mixture on a slide, cover with a cover slip and examine with a ¼-inch objective.

Prick the finger again, dilute the blood about 1 in 100 with distilled water. Place tiny drops of the mixture on a glass slide by means of a very fine paint brush. Place on a drop of xylol. Place this slide on top of the draw tube of the microscope. Examine the droplets with the Ramsden eyepiece, constructed as above, and focus the magnified images of the red cells at the same time. Shift the slides until a red cell and a droplet of solution are seen side by side in the eyepiece. The cells look greenish, whereas the solution looks orange; the difference in colour is usually quite striking. Droplets of different depths of tint may be tried, but none of them will be found to match the colour of the red blood cell.

The explanation is as follows. As is well known to the computers of optical objectives, the secondary spectrum due to uncorrected chromatic aberration tends to colour the edges of the images of all objects. The precise colours of the secondary spectrum depend on the two wave-lengths chosen for exact coincidence in the focal plane of the objective. In photographic objectives the colours of the secondary spectrum are often blue and yellow. In achromatic microscope objectives they are often blue-green and pink. In semi-apochromatic objectives they are often green and purple. These colours are well seen if an emulsion of two colourless fluids is observed with the microscope, such as xylol vigorously shaken with water. The droplets should be colourless, but when seen under the microscope appear to be tinted green, blue-green or blue according to the objective in use, and to have surrounding them narrow rings which are purple, pink or yellow respectively. The precise colour of this surrounding ring is often obscured by other aberrations which are present.

Consequently, when objects such as cells are observed under a microscope the colour presented to the eye will be that which results from combining the absorption of the dye in the object with the secondary spectrum of the objective. In the case of red blood cells, the faint orange or straw yellow of the hæmoglobin is modified by the green, blue-green or blue contributed by the objective, as the case may be, causing the cells to appear yellow or even yellowish-green. In confirmation of this, experiment shows that when red cells are observed through a fully corrected apochromatic lens, their colour is no longer yellow or yellowish-green, but the unmodified pale orange or straw yellow of the hæmoglobin alone.

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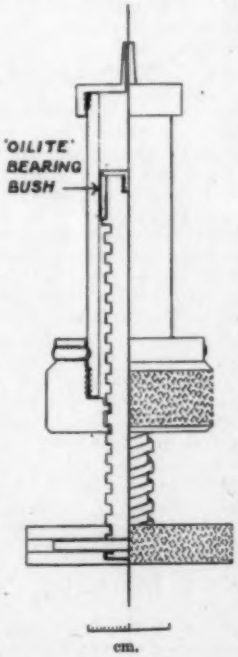
[1] NATURE, **152**, 331, 476 (1943).

Intracutaneous Injection of Cattle

DURING the course of investigations on the production of immunity to foot-and-mouth disease the intracutaneous route of vaccination has been considered. It has generally been recognized that one disadvantage of this route in large animals is that, owing to the pressure required, only a small volume of inoculum can be injected at one site. Various attempts have been made in the past to overcome this difficulty, and by means of compressed air Curasson, Dischamps and Andryesky[1] found it practicable to inject 10 c.c. of their rinderpest vaccine into the skin of the bovine scrotum and vulva.

With an ordinary hypodermic syringe it is possible to inject up to 5 c.c. of a watery liquid into the skin of cattle, but the pressure required is too great to make the injection of a number of animals a very practical procedure; it is only with very great difficulty that a more viscous liquid such as serum or defibrinated blood can be injected in such a large dose. There is also a tendency with a hypodermic syringe for some of the inoculum to leak past the piston.

With the help of Dr. E. Schuster of the National Institute for Medical Research, Hampstead, a special syringe has been designed for this work. The principal difficulty of providing sufficient pressure has been overcome by making use of the mechanical power of the screw.



The salient features of this syringe are shown in the accompanying diagram. It is of metal construction. The capacity of the syringe is 10 c.c. and it is filled and emptied by turning the knurled wheel on the end of the piston rod, the pitch of the thread on the piston rod being so designed in relation to the bore of the barrel that one turn delivers 1 c.c. The syringe can be dismantled by loosening the grub screws on the collar, unscrewing the collar and withdrawing the piston from the barrel. It is essential that the piston fits the barrel very closely, and in order to prevent these two metal surfaces seizing, the sides of the piston are formed by an 'oilite' bearing bush. Such a bush consists of sintered bronze impregnated

with oil, and is normally used for providing a self-lubricating bearing. The purpose of its incorporation in this syringe is to provide a thin film of oil between the piston and the barrel. To avoid losing the oil from this 'oilite' bush the syringe must be assembled before sterilization. With an accurately fitted piston a pressure of 50 lb. per sq. in. can be easily obtained, and at this pressure there is only a slight and insignificant leakage of the inoculum past the piston. Brass and phosphor-bronze were used for the construction of this first model; but there is no reason why stainless steel could not be employed or the brass syringe could be cadmium plated. This is mentioned as it may be thought desirable to avoid the possibility of some of the metallic ions in these alloys exerting a deleterious effect on the inoculum.

By the use of this syringe it has been found that up to 10 c.c. of liquids of various viscosities can be readily injected at one site into the skin of the neck of cattle. A full account of this work will be published elsewhere.

I am indebted to Mr. M. Gilbee of the National Institute for Medical Research, Hampstead, for his painstaking work in constructing this syringe.

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[1] Curasson, G., Dischamps, A., and Andryesky, P., *Bull. Acad. vét. Fr.*, **2**, 383 (1929).

Boiling Point and Viscosity

IN connexion with the communication by A. Dutta[1] connecting the ratio of η/η_B with that of T/T_B, where η represents viscosity, T temperature and the suffix B the boiling point condition, and obtaining a 'universal curve' for several gases it may be of interest to add the following facts.

From considerations of the mechanisms of both viscosity and evaporation, a relationship was obtained in 1939 for liquids in which the ratio η/η_B was found to be a function of T/T_B, expressed graphically[2]. It was found that certain groups of liquids, for example, homologous series, fell on a common curve. Further, there were three distinct regions describing associated, metallic and normal liquids. The position of these curves were further governed by the 'shape' of the molecule, but the most important consideration was the evidence from a fuller report of this work than my note appearing in NATURE, that "one law governs all viscous flow in all states of matter and that there must be a solitary equation giving the change, with temperature, of magnitude of viscous forces in flowing matter"[3]. This was in contradistinction from the prevalent view that the mechanism of viscosity in liquids is essentially different from that of gases. To formulate this universal law governing the viscosity-temperature relationship, the general equation for liquids,

$$\log \eta = K + K_1\left(\frac{T}{T_B}\right) + K_2\left(\frac{T}{T_B}\right)^2 + K_3\left(\frac{T}{T_B}\right)^3,$$

was solved[4]. It was found that all paraffins containing four or more carbon atoms are governed by

$$\log \eta_P = 6{\cdot}283 - 18{\cdot}572\left(\frac{T}{T_B}\right) + 17{\cdot}505\left(\frac{T}{T_B}\right)^2 - 5{\cdot}900\left(\frac{T}{T_B}\right)^3,$$

and further, that for the other liquids the viscosity at the same value of $\left(\frac{T}{T_B}\right)$ as that for the paraffin was governed by

$$\log \eta = A - B\,(6{\cdot}283 - \log \eta_P).$$
$$= C + B \log \eta_P.$$

Further[5], as

$$\log \eta = A f(T) + \frac{Q}{2{\cdot}3RT},$$

where Q is energy of activation of viscosity, therefore

$$\Delta\left(\frac{Q}{T}\right) = -2{\cdot}3\,R\,\Delta\left\{18{\cdot}572\left(\frac{T}{T_B}\right) - 17{\cdot}505\left(\frac{T}{T_B}\right)^2 + 5{\cdot}900\left(\frac{T}{T_B}\right)^3\right\}.$$

Thus the energy of activation, for the viscosity of liquids, in parallel with that of evaporation, was found to decrease, ultimately, with temperature and vanish at the critical point. This is due to the fact that the energy of activation is the result of two energies, a positive and a negative energy, both increasing with the temperature but at unequal rates, becoming equal at the critical temperature. Above the critical temperature the negative energy is of greater arithmetical value than the positive, indicating a rise of viscosity of a gas with temperature. All this involves working under the pressure of the saturated vapour. For low pressures the influence of pressure is negligible.

At the present time work is proceeding on passing from the liquid to the gaseous state through the critical temperature, in the hope that if the single equation for all states works as well with gases as liquids under these conditions, it may be extended to vapours and gases under different conditions.

There appears to be no doubt that the use of T/T_B as a criterion for levels of temperature affords distinct possibilities to the understanding of the mechanism of viscosity—possibilities not so readily available using other 'reduced temperature' scales.

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A Dental Survey of the British Isles

THIS is a general report on the effects of war-time diet on the dentition of 9,400 youths in England and Wales, Isle of Man, Northern Ireland and Eire. In the last-named place until April 1943, meat, eggs and milk, sweets and chocolate have not been rationed; sugar and tea have since been controlled and butter only partially.

The scheme of assessment of dental decay employed in the investigation recognizes as bad or decayed, teeth extracted for orthodontic reasons, teeth lost as a result of caries or of accidents at games, and from all other causes. None the less, in the present survey only four cases were actually listed as due to accidents.

The factors controlling dental growth are proteins, fats, carbohydrates, minerals like calcium, phosphorus, iodine, iron, sodium, potassium, magnesium and copper; vitamins A, B, C, D; and hormone-secreting glands like the parathyroids. According to Fish[1] there is a factor, an immune saliva, a product of healthy general metabolism, which prevents dental decay and which is more frequently found in boys than girls. It is believed that excess of vitamin D is likely to lead to malformation of teeth, but Soma Weiss[2] denies the existence of any toxic effects from excessive administration of vitamins.

Vitamin A omitted from the diet will lead, among others, to infections of parodontal tissues and pyorrhœa. It is intimately connected with dental development.

The sources of the minerals and vitamins essential for perfect dental growth are dairy products such as eggs, butter, milk and cheese; marine fish and their oils; summer fruits, green vegetables and citrous fruits. "At the present time," wrote Prof. Mottram[3], "it looks as though the British diet may soon become deficient in first-class protein, iron and calcium and most, if not all, the vitamins."

The factors concerned in the etiology of dental caries are numerous, and even now are not all quite well understood. Miller of Berlin found that caries is due to *L. acidophilus*. Others maintain that gingivitis and dental decay may be due to food debris clinging to interdental spaces where the bacterial flora has optimal conditions for growth and multiplication. Most American workers hold the view that a pulpless tooth acts as a septic focus for the eventual infection and destruction of dental structure. Soviet workers like Entin of Leningrad and Lukomsky of Moscow reject the chemobacterial theory of American workers; but Entin believes in apical irritation, and Lukomsky in allergy, as etiological factors in caries. Both lay stress on diligently seeking means of preserving the teeth.

Lady Mellanby[4] found in 1929 that increased liability to dental disease and gross hypoplasia of teeth may be the result of defective maternal diet especially in mineral salts. N. Simmonds[5] states that the low incidence of dental caries among indigenous populations has not been the result of any one dietary regimen. Klein and Palmer[6,7] postulate the existence of caries immunes and caries susceptibles, but deny the influence of socio-economic status on the incidence of caries.

I believe that dental decay is due to the destruction of the dentine and enamel by bacteria, by refined foodstuffs like white flour, cereals, and white sugar, by chemical abrasives and by too frequently boiled milk, and occasionally by fluorine in drinking water.

In the accompanying table, of the total (9,400), 3,480 are from the public schools and colleges, 5,770 are factory girls and the rest from two model elementary schools.

It is obvious from the peculiar nature of the problem we set ourselves that any conclusions we may arrive at must form the point of departure for subsequent workers since there are no previous comparable data to work on. We may, we believe, safely infer from this sample that at least until July of this year (1943) war-time diet, scarcity of sugar, sweets and chocolates have had no damaging effects on the nation's teeth since the dental status of English boys and Manx girls approximate that of Eireann boys. It also follows that abundance of sugar and sweets has in no way destroyed the dentition of Eireann students.

Public Schools (ages 12–18) No. of teeth lost	0 %	1 %	2–3 %	4+ %
English boys	61·18	13·14	15·98	9·60
English girls	46·96	17·49	21·16	14·39
Welsh girls	48·64	14·25	21·05	16·06
Manx girls	62·00	7·00	17·00	14·00
North Irish boys	53·76	19·36	19·84	7·04
North Irish girls	57·00	16·67	19·47	6·86
Eireann boys	62·50	14·58	15·27	7·65
Eireann girls	50·87	16·37	24·00	8·76
Post Public Schools (ages 19–22) English T. Coll. girls	21·70	17·84	27·13	33·33
North Irish Elementary Schools (ages 10–14): Boys	41·50	27·00	23·50	8·00
Girls	55·00	20·00	15·00	10·00
Factory girls (N.I.) (ages 14–24)	10·00	5·00	35·00	50·00

It is only when we compare English college girls with English public schoolgirls, and Northern Irish factory girls with their schoolgirls, that gross differences in improvement of the younger generation become apparent. It is statistically significant that in both Eire and England more boys have perfect teeth than girls.

I gratefully acknowledge my indebtedness to Dr. R. L. Wilbur, chancellor of Stanford University, Dr. N. Simmonds of the College of Den istry in the University of California, Miss Slane and Dr. F. Boudreau of the Milbank Memorial Fund of New York, Mr. L. McKenzie and Dr. W. McTavish of Upper Canada College, Toronto, for their kind interest and generosity in freely placing at my disposal, recent publications on child health issued by their several institutions.

I wish to express my sincere thanks to the principals, headmasters and headmistresses of the following schools in England: Rugby, Repton. King's College (Taunton), the Abbey School (Malvern), Edward Brooke's (London), Chelsea Polytechnic, Liverpool Training College, Felixstowe College, Bishop Blackall's (Exeter), Notre Dame Collegiate (Liverpool). In Wales, Howell's School (Denbigh), Howell's (Llandaff and Cardiff). In the Isle of Man, Buchan School (Castletown). In Northern Ireland, Londonderry High School, Collegiate School for Girls (Enniskillen), Coleraine Academical Institution, Technical High School of the College of Technology (Belfast), the Model Elementary Schools of Omagh and Enniskillen. In Eire, St. Columba's College (Rathfarnham near Dublin), High School (Sligo), Celbridge Collegiate School (Co. Kildare), Drogheda Grammar School.

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RESEARCH ITEMS

Tularæmia in Shrews

GLEN M. KOHLS, assistant entomologist, and Edward A. Steinhau, associate bacteriologist, confirm (*Public Health Rep.*, **58**, 842; 1943) the occurrence of spontaneous tularæmia in the shrew (*Sorex vagrans monticola*) and the field mouse (*Microtus pennsylvanicus modestus*) by the following examinations of the animals. Three shrews and ten field mice were caught in traps. No gross lesions were found at autopsy, but the spleens and livers of each species were pooled and injected into four guinea pigs which died from six to twelve days later with gross lesions suggestive of tularæmia. *Pasteurella tularensis* was isolated from the spleen and liver of two of the guinea pigs given the shrew tissues and in three of those that received the field mouse tissues.

Tyroglyphid Mites in Stored Products

TYROGLYPHID mites, which include cheese mites and flour mites, infest most kinds of stored products. They are common also on mushrooms and in laboratory cultures of insects. A vast amount of scattered information exists regarding these creatures, much of which is valuable but greatly in need of being collated and made more readily accessible. As a guide and introduction to the study and control of these mites a recent pamphlet by M. E. Solomon entitled "Tyroglyphid Mites in Stored Products", published by the Department of Scientific and Industrial Research, is to be commended (London: H.M. Stationery Office, 1943. 1*d*. net). The knowledge thus brought together is well arranged under suitable headings and there is a bibliography of about 250 references. With few exceptions, the literature of the nineteenth century has been omitted, since it is listed and discussed in the well-known monograph of British Tyroglyphidæ by A. D. Michael. In the discussion at the end of this pamphlet it is pointed out that a long-standing need is for a unified system of classification with complete keys to the genera and species. This desideratum has to a great extent been fulfilled by the work of Zakhvatkin (1941). Its complete translation from the Russian would considerably assist British workers. The importance of moisture in the ecology of these mites is stressed. As a control measure, dry-storage of susceptible products is of first importance. There is also need for quantitative data on the rate of increase and damage done by mites under different conditions. Another requirement is more critical work on control measures, with special reference to the resistant egg and hypopus stages.

Feeding Apparatus of Biting Flies

R. E. SNODGRASS has described and figured the mouth-parts of biting and disease-carrying flies as a war-time contribution to medical entomology (*Smithsonian Misc. Coll.*, **104**, No. 1; 1943). As the author points out, most text-books of medical entomology do not describe the feeding organs of such insects in sufficient detail to be adequate. The present paper is intended to supplement such texts and thus to make available to teachers and students a condensed but detailed account of what is known to entomologists concerning the mouth-parts of the kinds of flies mentioned. The author has drawn freely upon modern literature on the subject besides incorporating observations of his own. As he points out, some of the most thorough investigators are specialists in a particular group, and do not give sufficient attention to other insects to make reliable interpretations of the homologies of some of the organs involved. A case in point is the use of the term *tormæ* by so many writers with reference to the anterior plate of the fulcrum. As pointed out by Patton and Cragg and also by Imms, this plate is the homologue of the clypeus of other insects. The memoir brings together, within convenient compass, a detailed account of the organs concerned, together with a number of clearly executed text figures, the majority being original. It can be recommended to investigators and teachers alike. A bibliography of the more modern literature on the subject is appended.

The *Rh*-Factor of Blood

IT has been recently shown that the dominant agglutinable factor *Rh* of blood is associated with a specific disease of the newly born and that still-births and abortions may result from the interactions of the blood groups of mother and fœtus. P. Levine (*J. Hered.*, **34**, 71; 1943) summarizes recent work and indicates that anæmia of the newly born, erythroblastosis fœtalis, results from genetic differences in the antigenic compositions of the erythrocytes of the parents. The actual mechanism depends on the iso-immunization of the mother by the *Rh*-factor in the blood of the fœtus and the intra-uterine interaction of maternal anti-*Rh* agglutinins on susceptible fœtal blood. Evidence is presented which indicates that other blood group factors may also be responsible for some forms of fœtal death (see also NATURE, September 11, p. 300).

The Phæophyceæ

IN the third paper of the series "Studies in the Comparative Morphology of the Algæ", F. E. Fritsch discusses the possible interrelationships of the orders in this group (*Ann. Bot.*, **7**, No. 25; 1943). The assemblage of forms included in Oltmanns' Ectocarpales (except the oogamous Sporochnales and Desmarestiales) illustrates experiments in elaboration of the diploid thallus, the most important of which is probably the development of polystichous (parenchymatous) forms by the appearance of division walls in various planes in the cells of the primary, heterotrichous thallus. In this group the growth is usually intercalary (trichothallic), but some members relatively early lose the part distal to the meristem and assume apical growth; this point may be significant when considering the interrelationships of forms with apical and intercalary growth; in Fucus the apical cell of the adult plant is preceded by a hair with intercalary growth in the juvenile stage. In spite of pointers of this kind in the Ectocarpales, Fritsch concludes that the more specialized orders have no direct affinities with one another and must be regarded as separate evolutionary lines emanating from simple filamentous forms with an isomorphic life-cycle. The lines of development accompanying the heteromorphic life-cycle show the higher degrees of somatic differentiation. The tabulated scheme indicates markedly the isolation of some of the orders. The higher orders receive independent discussion and comparison. The Tilopteridales still remain a problem in classification: Sauvageau's

original contention, that the monosporangia on plants of either generation represent accessory asexual reproductive organs, seems to be supported by the more recent observation of larger, amœboid units liberated from lower compartments of the plurilocular sporangia of Tilopteris; possibly these may be female gametes and be equivalent to the swarmers liberated from the relatively large compartments of plurilocular sporangia of Acinetospora. Within comparatively recent years a considerable amount of literature has appeared, particularly in connexion with brown algæ, and these papers by Prof. Fritsch are very valuable in bringing the new work, some of which is in journals not always readily accessible, under discussion in a review of the present position of our knowledge of the algæ.

Taxonomy and Distribution of the Fungi

An interesting computation of the numbers of fungi by G. R. Bisby and G. C. Ainsworth (*Trans. Brit. Mycol. Soc.*, **26**, Pts. 1 and 2; April 1943) places the world total at 37,500, of which about nine thousand have been recorded from Great Britain. These numbers are subject to constant addition, and in the same *Transactions*, two new species belonging to the mould genus Aspergillus are described by G. Smith. They are *A. avenaceum*, from dried peas, and *A. proliferans*, isolated from cotton. No special characters likely to be of use in industrial chemistry are reported, though the genus is otherwise rich in such activity. A further new species, *Sphaceloma Murrayæ*, is also described by Anna E. Jenkins and Leon Grodsinsky from New Zealand. It causes a destructive disease on willow, and was formerly considered to be a species of Gloeosporium. A. A. Pearson, in the same journal, describes twenty-three new British records for Agaricaceous fungi, or species for which further descriptions are now available. They belong to most of the commoner genera, and two new combinations, *Astrosporian umboninota* and *A. Boltonii*, are perhaps of special interest since their extraction from the genus Inocybe is based upon well-defined spore characters. A very detailed account of British Nectrioideæ and allied genera by T. Petch, published in the same volume, considers the highly coloured forms of Saccardo's assemblage the Sphaeropsideæ. It is chiefly a modern evaluation of von Höhnel's work on the same groups, with useful keys and descriptions of type-species.

Soil Pests of the Potato

A short paper by G. Fox Wilson (*J. Roy. Hort. Soc.*, **68**, Pt. 7; July 1943) describes several insect pests which live in the soil and attack potato tubers. Wireworms, slugs and millepedes are all too common visitors; but leather-jackets, cockchafer grubs and cutworms also cause damage. Particular interest is attached, however, to the inclusion of swift moth caterpillars as potato pests. These were formerly thought to feed mainly on the roots of grasses, but most horticultural advisers would agree with Mr. Fox Wilson that they have recently exhibited more predatory tendencies upon several food crops, including potatoes.

Variations in Radioactive Data

Information concerning the distribution of the radioactive elements in rocks is of fundamental geophysical importance because of the influence of radiogenic heat on the thermal behaviour and history of the earth. A report on recent work bearing on the causes of variation of such radioactive data has been given by N. B. and A. R. Keevil, W. N. Ingham and G. P. Crombie (*Amer. J. Sci.*, June 1943). The greatest differences—indicating variations in radioactive content by a factor of fifty or more from specimen to specimen—occur in certain granitic rocks, due mainly to varied concentrations of accessory minerals, chiefly zircon and apatite, which are often highly radioactive. It has also been discovered that in the case of the Bourlamaque batholith, Quebec, there is a marked concentration of the radioactive elements towards the border of the mass. The contact rocks of this area are also exceptionally radioactive, and since they are highly albitized and silicified it is reasonable to attribute the enrichment to diffusion of material from the batholith. Regional variations are less pronounced, but it is clear that certain provinces, as in Colorado and the Great Slave – Great Bear region, are relatively highly radioactive, whereas others, such as parts of Ontario and Quebec, are relatively barren. In sedimentary rocks the effect of mixing of materials from different sources tends to produce uniformity of radioactive content. It is clear from the general results of the survey that many more data from representative areas are necessary before the laws governing the distribution of radioactivity in the earth's crust can be fully elucidated.

Short-Period Erratics of Free Pendulum and Quartz Clocks

W. M. H. Greaves and L. S. T. Symms have discussed their investigations of the performance of Shortt clocks and quartz-controlled clocks during 1942 (*Mon. Not. Roy. Astro. Soc.*, **103**, 4). The work is limited to short-period erratics, but recent developments suggest that the superior performance of the best quartz-controlled clocks extends to long-term performance. Three types of erratics were recognized. The first of these represents accidental erratics in the clocks themselves arising from random fluctuations, about a mean value, of the phase at which the seconds impulses are taken, and also includes errors of chronographic recording and measurement. The second type, accidental errors affecting the first differences, may arise from accidental fluctuations of rate about a mean value, or from accidental changes of phase, and it is impossible to distinguish these two kinds of erratics. The third type affects second differences and arises from accidental changes of rate. For clocks of the standard free-pendulum type, all three types of erratics are present in appreciable amounts, but for the quartz clocks the erratics of the second and third types are too small to be detected by the analysis, and erratics of the first type are predominant. The origin of erratics of the last type is obscure, but they exist in pendulum clocks, and as their effect on clock errors is cumulative, they are the most serious from the point of view of long-period performance. The second type of erratics also tends to produce a cumulative effect on clock errors, but, so far as long-period performance is concerned, they are not so serious as the third type. The first type of erratics does not affect the long-period performance of a clock. In so far as the long-period performance of a clock arises from the integrated effects of the short-period erratics, it is concluded that good quartz clocks are very superior in long-period performance to the best clocks of the standard free-pendulum type.

POST-WAR RELIEF IN EUROPE

IN opening a Conference, organized by the London Area Committee of the Association of Scientific Workers, on "Problems of Freed Europe—the Challenge to Medical Sciences", held on October 2, the chairman, Dr. Douglas McClean, pointed out that the task is one in which many aspects of science are deeply involved. Obviously experts in nutrition, agriculture, veterinary science and the medical sciences will have a considerable part to play in restoring reasonable standards of life; no less important will be engineers, architects, economists and a host of other trained people. It was the purpose of the Conference to direct attention to this point of view, to consider what the needs are likely to be, what mechanism and plans already exist, and in what ways they can be modified and improved.

The first part of the Conference was devoted to reports, from representatives of several Allied or occupied countries, describing the existing conditions so far as they are known. Dr. B. Kruta, chairman of the Czechoslovak Nutrition Committee, detailed the progressive diminution of supplies following the German occupation. The country was previously largely self-supporting in its food production; the producers are compelled to contribute quotas to the State-controlled retail corporations, with severe penalties for non-compliance, but are allowed to retain part of their produce for themselves, their families and animals, and for seed. The townsfolk are worse off in that they have fixed nominal rations but have no guarantee of actually being supplied. The general diet is deficient in fats, in vitamins and in energy content by 500–800 calories a day; the total protein content is low—about 40–50 gm. a day, of which only about 10 gm. is first-class protein. The greatest deficiencies occur in the diet of adolescents. The obvious malnutrition is accompanied by all the attendant increase in ill-health and disease.

Dr. A. Marteau told of similar, but even worse, conditions in Belgium where the bulk of the population has to exist on half a pound of poor-quality bread, 1 lb. of potatoes (in very irregular supply) and, when available, a few vegetables and 1 oz. of meat a day. Coupons for fats are issued, but the rations can often not be obtained. The position in Greece, reported by Dr. A. P. Cawadias (president of the Greek Red Cross) can only be described as complete famine, due mainly to the fact that the country normally produces only a very small proportion of its food requirements and is of very little value to Germany industrially or as a source of raw materials; its inhabitants are, therefore, not worth feeding. A certain amount of relief, equivalent to about 700 calories per head per day, has been reaching Greece since the spring of 1942, but it is quite inadequate to prevent the diseases of malnutrition and the epidemics which are rife.

Prof. S. A. Sarkisov (Soviet Red Cross) gave a picture of the tremendous amount of destruction of every sort which has followed the German invasion of the Soviet Union. Horses, cattle, sheep, grain and other foodstuffs in vast quantities have been removed, agricultural land put out of cultivation and buildings and machinery destroyed. As a consequence there is the usual tale of famine and disease. Already in the areas which have been liberated by the Red Army the work of restoration of hospitals and medical centres, housing and agriculture is proceeding. Feeding centres, public baths, kitchens, bakeries and so on are set up immediately, and medical centres, with their supplies and equipment, as soon as possible.

Prof. J. R. Marrack then dealt with the present plans for relief. The problem after this War will be greater than after the last as more primary production centres have been involved and the East will also have to be considered. On the other hand, the Allied Post-war Requirements Bureau has been assessing the needs in food, medical supplies, seeds, livestock, etc., which will arise after the War, whereas, in 1918, relief had to start without plans. In addition, the United Nations Relief and Rehabilitation Administration (UNRRA) is being built up in order to deal with the problem. UNRRA will have power to distribute such stocks as may be available and to make appropriate plans, but will not have overriding power to obtain food, raw materials or shipping for transport. The actual amounts needed will be small compared with total consumption of the United Nations and, in most cases, could be provided readily if rationing in those countries were continued for a time after the War. Controls on transport would also need to be maintained in order to provide the means of getting the supplies to the people needing them. This should be the function of a Supreme Economic Council.

Mr. F. Le Gros Clark, in opening the discussion, maintained that one of the chief duties of the relief organizations will be to co-operate with the nationals on the spot. Imports of all sorts should be made available as an inducement to local producers to part with surplus stocks and to remove the motive for, and profit from, hoarding. Great care will be necessary in selecting personnel in order to avoid maladministration. Dr. Geoffrey Bourne pointed out that the occupied countries could be grouped according to the severity of their deficiencies determined by their degree of self-support and the use of their industries to Germany. The main shortages everywhere are in calories, calcium, vitamins and first-class protein. Dr. Bunting considered that one of the chief problems will be the restarting of agriculture and said that the problem will vary with each country liberated and with the season at which it occurred. He suggested that local crops should be retained for seed, since they suit local conditions, and that imported produce should be used for food. Mrs. Bamford (of the Fabian International Bureau) stressed the importance of not allowing the withholding of relief to be used for political blackmail. She agreed with Prof. Marrack that production and distribution should be under the control of a Supreme Economic Council and that rationing should continue on the principle of "bread for all before cake for any".

Dr. Mark Daniels and Mr. W. D. Hogarth discussed the need for training personnel and the methods by which it could be achieved with the minimum of dislocation of the present position. Welfare workers have the requisite basic training, on to which special requirements could be fairly easily and quickly grafted. Dr. Ungar is of the opinion that mobile teams of physicians, bacteriologists, etc., will be needed to deal with epidemics wherever they might break out. Dr. Kuczynski maintained that Germany must play its part in reconstruction by providing medical supplies, vitamin preparations, instruments and so on, as well as general industrial relief.

Dr. S. C. Dyke (president of the European Association of Clinical Pathologists) proposed that the Conference should pass a resolution urging on the

Government that there should be no relaxation of rationing until the needs of occupied Europe have been supplied. Mr. Le Gros Clark introduced an amendment that, as an essential preliminary, a wide campaign of education be undertaken to explain to the public the necessity for such a measure. The amended resolution was carried with acclamation.

RATIONS AND FOOD CONSUMPTION IN SWEDEN DURING 1942-43

By CARIN BOALT and YNGVE ZOTTERMAN

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AN investigation of the individual food consumption of fifty-two households and one lumbermen's canteen in Sweden has been made during the winter 1942–43. In seventeen of these households the breadwinner was a lumberman, in twenty a millworker, and in fifteen households a clerk in a factory or a bank. Thus men doing physically heavy outdoor work, heavy factory work and very light indoor work were represented. The total number of persons concerned was 212, of whom 76 were men, 59 women and 77 children under fifteen years of age. The investigation continued for fourteen successive days, during which the subjects weighed and checked all food eaten. Moreover, a complete account was kept over household purchases of food and the food received in kind.

From these data calculations were made of the consumption of different foods, the supply of the more important food factors, the cost of food and the diet. This material makes possible comparative inquiries into the influence of occupation, age and sex upon the diet and standard of nutrition.

The lumbermen showed the highest consumption of energy, with an average of 4,600 (large) calories for 24 hours, thereafter came the millworkers with 3,800 calories, and far behind them the clerical workers with 2,600 calories. The women's consumption of energy was 2,500 calories for lumbermen's wives and 2,200 calories for the other groups. The children's energy consumption increased linearly with age. A scale of food energy standards has been worked out on the basis of these results. This showed that the children's consumption of energy was higher than what was earlier reckoned on, while on the other hand the women's consumption was lower.

From the body-weight, height, age and sex, the basal metabolism of each subject was calculated according to well-known empirical formulæ. In order to illustrate the influence of the occupation upon the energy metabolism, we have worked out what we call the activity quotient, namely,

$$\frac{\text{energy supply (net)} - \text{basal metabolism} \times 100}{\text{basal metabolism}};$$

in other words, the energy supply exceeding the basal needs was expressed as a percentage of this latter value. This quotient proved to be for the lumbermen 186, for the millworkers 132 and for the clerical workers 67 per cent. The total activity in regard to the physical work done in 24 hours thus varied as 3 : 2 : 1. The women showed in this respect a low activity quotient with 76, 59 and 58 per cent for, respectively, the lumbermen's, the millworkers' and the clerks' wives. The children showed a great dispersion; no differences could be traced between boys and girls.

Comparisons between the consumption and the rations showed that the lumbermen exceeded their rations of flour and grain as well as fats by an average of 60 per cent. Even the millworkers exceeded substantially their rations of these foods, whereas the clerical workers and the women lived within their rations. For the youngest children, generally speaking, consumption was considerably below their allotments.

The investigation has accentuated the desirability of a strongly differentiated system of food rationing where the greatest possible consideration should be given to occupation, age and sex. A general principle during partial rationing should be to balance the rations so that an individual's energy requirement can be covered by a reasonable consumption of free foods. Thus it was shown that millworkers, whose rations gave 2,000 calories per day and whose energy consumption was 3,800 calories, received 2,500 calories from rationed foods and only 1,300 calories from free foods. Probably we must therefore reckon with the fact that in practice not more than 1,500 calories might be taken from such foods as milk, potatoes and other roots, which during the winter 1942–43 were not rationed in Sweden.

As concerns the children's consumption, certain foods, as, for example, flour and meat, showed a high correlation with age, whereas other foods such as milk and sugar did not show any increase with age. Among the adults there were great quantitative differences in the consumption of different foods between men and women in workmen's households. In the households of clerical workers, men and women had a very uniform diet.

The protein supply for men and children was kept well above the desirable level, while the women on average just reached this level, which means that a considerable number of women did not receive the

DAILY RATIONS IN SWEDEN IN FEBRUARY 1943

	Meal and grain (gm.)	Fats (gm.)	Meat (gm.)	Sugar (gm.)	Peas (gm.)	Cheese (gm.)	Eggs (gm.)	Calories contained in the daily rations
Children born 1942–43	152·0	35·7	14·3	60·6	8·0	4·2	5·4	1146
" " 1939–42	152·0	35·7	14·3	60·6	8·0	4·2	5·4	1146
" " 1938	193·7	35·7	28·6	60·6	8·0	4·2	5·4	1334
" " 1936–37	193·7	35·7	28·6	60·6	8·0	4·2	5·4	1334
" " 1931–35	214·5	44·6	28·6	60·6	8·0	4·2	5·4	1476
" " 1927–30	235·3	44·6	28·6	60·6	8·0	4·2	5·4	1549
" " 1924–26	235·3	44·6	28·6	60·6	8·0	4·2	5·4	1549
Ordinary rations	193·7	35·7	28·6	60·6	8·0	4·2	5·4	1334
Heavy workers	360·3	53·6	28·6	60·6	8·0	4·2	5·4	2060
Lumbermen living at home	443·7	53·6	57·1	60·6	8·0	4·2	5·4	2736
Lumbermen not living at home	402·0	53·6	55·6	100·0	18·7	4·2	5·4	2781
Pregnant women	193·7	53·6	28·6	60·6	8·0	32·8	22·5	1569

desirable supply of proteins. This was particularly the case among the millworkers' wives. The supply of calcium and phosphorus was in the main satisfactory for all groups, whereas the consumption of iron among the smaller children and the women was below the desirable level.

The vitamin A supply showed a very wide dispersion. Starting from a minimum requirement of 2,000 I.U., the supply of vitamin A to the men of all three groups was above this value. The optimal supply of 4,000 I.U. has not been reached by any but a few lumbermen. Only one fourth of the number of the children seemed to have reached the optimal level for their age. With regard to the supply of vitamin B, the minimum and optimum requirement for adults is generally given as 0·75–1·50 mgm. vitamin B per day. The women and children have, on the average, not reached this optimum, and a few women showed a consumption below the minimum requirement. The supply of vitamin C was for all groups in the main above what has been considered to be the minimum, namely, 25 mgm. per day. The mean values for all groups of adults except those for the millworkers' and the lumbermen's wives were greater than 50 mgm., which is generally considered as the optimum. Among the children the supply of vitamin C was only exceptionally below 20 mgm. The mean value was about 40 mgm., but the dispersion was very great. The supply of vitamin C did not show any correlation with age, in contrast to the consumption of vitamin A and B, which increased linearly with age.

In conclusion, it can be said that the diet of our subjects seemed to be relatively satisfactory according to generally accepted ideas.

The women's consumption of food was, however, so small that their intake of iron and of vitamins A and B became rather low. The fact is, however, that the relation between the energy metabolism and the requirement of the different food factors is not as yet sufficiently well known to permit us to draw any safe conclusions concerning the women's nutritional standards. The same is the case in regard to the children's requirement of minerals and vitamins at different ages.

The money value of the food has been computed for all household groups and subjects by adding together the cash outlays for food and the value of the produce received in kind. The cash outlays for food for fourteen days amounted to 48 Sw. crowns for the lumberman's household, 51 crowns for the millworker's household and 71 crowns for the clerical worker's household, which was equivalent to 53, 39 and 28 per cent of the respective cash income. The total value of the food amounted to respectively 75, 58 and 76 crowns.

The cost of the daily food was on the average 1·73 crowns for the lumberman, 1·96 crowns for the millworker and 1·70 crowns for the clerical worker. The cost of food per 1,000 calories was respectively 0·38, 0·52 and 0·65 crowns.

Concerning the children, the food cost for the young children was about 0·90 crowns a day and for the school-children about 1 crown a day. The increase with age was thus inconsiderable. On the other hand, the food cost for the children belonging to clerical workers' families increased from 1 crown to 1·50 crowns. These children enjoyed also a relatively more expensive diet than the children of the manual workers. Thus the price per 1,000 calories for young children belonging to clerical workers' households was 0·73 crowns, whereas food of the clerical workers' young children cost about 0·50 crown.

These figures might be taken as an expression for the difference in the standard of diets between the household groups in question. The lumbermen's households, where the men as well as the women and the school-children showed a higher food consumption than in the other household groups, lived upon a cheaper diet, which, however, in qualitative respect was not inferior to that of the other groups. Their diet was, however, rather monotonous. The clerical workers' households, which showed the lowest food consumption but the highest food expenses, showed, however, from the qualitative aspect a standard which was only insignificantly higher. Their diet was, however, much more varied, which among other things expressed itself in their choice of dishes and variation in the way of preparing them.

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THE ELM TREE

By ALEXANDER L. HOWARD

THE elm tree, which on account of its peculiar habit of growth has become an outstanding feature of the English countryside, of which the genius of both British and Continental painters have taken full advantage, seems doomed to extinction; the tree is beset by too many enemies. With the breaking up of the large estates there is no one left to preserve it. For upwards of one hundred years no Government has existed in Great Britain which has shown any well-defined interest or devoted any tangible efforts towards reafforestation, and only in the course of the last twenty years, or less, has the subject been given consideration. Even during this period the main effort has been directed towards the financial rather than the national aspect.

It is interesting and instructive to contrast the labour and pains taken by those who preceded us—Virgil, Pliny, Evelyn and others—to ensure a plentiful supply of trees with those feeble efforts which are practised to-day. For upwards of two hundred years few foresters have studied the means of the reproduction of elms, or the dangers imminent to the young trees, although we have possessed the knowledge of every kind of device, with explicit instructions as to how to plant, rear and establish them.

Although the life of the elm may be sustained for upwards of six hundred years, and it is rarely struck by lightning, it is very liable to be blown down. The roots, travelling horizontally, will not hold down their weight. At an earlier age than other trees the elm is apt to become rotten at the heart. The tree is a prey to elm bark disease, which is very destructive; and what is worse, man has been very cruel and unkind to it. As an example of disease, the beautiful avenue of elms in Windsor Park has been condemned as beyond recovery. The wood, although ill-considered and costing less than that of most hardwood trees, is, nevertheless, extremely useful, and indeed more generally employed than is commonly known.

There are about twenty species, of which only

two are prominent in the United Kingdom—the common elm (*Ulmus campestris*) and the wych elm (*Ulmus montana*)—with perhaps nine or more hybrids or varieties. Whether the common elm or its varieties have been introduced or are indigenous to Great Britain is in doubt, but it seems generally accepted that the wych elm is indigenous.

The common elm was largely planted by our forefathers as roadside trees and avenues, and has become especially prominent in our hedgerows, while the latter has been extensively cultivated around the stately mansions and in parks throughout the country.

Boulger says of the wych elm:

"Though more abundant to the north of the Trent, it is, wherever it occurs, less distinctly a hedgerow tree than its congener, though its name *montana*—the Mountain Elm, which seems to have been applied to it in very ancient times, is not very appropriate."

Strutt says in his "Sylva Britannica" that the common elm is indigenous to England, and we hear that the Romans made a practice of feeding their cattle on its leaves—a use which would probably surprise the extravagant farmer of a later age.

Evelyn, in his "Sylva", says of the Dutch elm, which he terms *Ulmus Hollandica*:

"was brought from Holland about the beginning of the reign of King William, and was employed in forming hedges in gardens; but that taste being now justly exploded, the tree is no longer noticed in this country."

Evelyn states that

"the Wych Elm [which he calls] *Ulmus campestris*, is the only species that grows in Great Britain, the rest being varieties."

Other authorities do not appear to agree with him. As regards his statement that the Dutch elm "is no longer noticed in this country" his opinion may have been well founded in his time, but to-day great numbers of Dutch elm (*U. major*) are to be found in the woodlands, gardens and parks of the landed gentry and municipalities. Of late years the wood of the Dutch elm has been sought in preference to either that of the common or the wych elm, but it is doubtful if in general it serves so many useful purposes as the wood of the latter.

As has been seen, according to Elwes the common elm is termed *U. campestris*, the name originally given by Evelyn to the wych elm. Elwes quotes as follows:

"John Harrison, nurseryman at Cambridge, plainly means *U. campestris* by the English Elm, in his New Method, 33 (1766): 'That which we call the English elm, is peculiar only to the southern part of this island, where it grows wild in hedgerows: there is not a trace of that kind to be seen in the northern counties, but what has been planted within seventy or eighty years; and these are either in avenues or some plantations near gentlemen's seats.'"

Elwes also gives an account of a very remarkable elm at Huntly Manor, Gloucestershire, the seat of Mr. B. St. John Ackers, which has a watercourse running through the middle of the root. He says:

"Mr. Ackers tells me that if you put a ferret into the root on one side, it can pass through and come out on the other, which shows that the butt is partly hollow, though the tree looks sound and is about 100 feet high. It is difficult to explain the origin of this curious freak."

According to Boulger the common elm is *U. surculo'sa*.

Authorities differ as to the origin of the term 'wych', sometimes spelt 'witch', and it has been sometimes, especially in the south, called 'wych hazel', the word 'hazel' having been applied probably owing to the fact that the leaves resemble those of the hazel, while the name 'wych' may have been taken, as Dr. Prior thought, from the early English 'hwaecce', the French *'huche'*, a chest, our modern 'hutch', the wood of this tree having been used for these purposes.

Boulger refers to the origin of the name wych elm, and quotes Turner in his "Names of Herbes" (1548):

"Vlmus is called in greeke Pteles, in englishe an Elme tree, or a Wich tree, in duch ein Vlme baume, or Ylmen or Rust baume, in frenche Orme",

the latter name 'rust baume' being the common name by which the wood is known in those countries where it is used more extensively than here, namely, Austria and Hungary, to which reference will be made later.

The habit of the two trees differs widely, the beauty of the common elm being in its unusual and distinctive manner of growth, forming somewhat the appearance of a series of rows of green sprays, one above the other at intervals; while the habit of the wych elm is majestic and stately, the branches adorned by deep green leaves, which spread in graceful sweeps from the noble crown, descending often to the very ground beneath. The foliage again varies: in the early spring the common elm displays tender shoots which are almost of a purple colour, turning later to a vivid green, and changing in the autumn to a golden tint, while those of the wych elm hold their dark green colour throughout. A very graceful specimen of this tree may be seen in full vigour by the wide road across Rotten Row, in Hyde Park, London.

The Cornish elm, named by Evelyn *Ulmus sativa*, and by Elwes *U. stricta*, must not be overlooked. It will not compare with the common or wych elm for beauty or majesty. While it may perhaps be suitable for avenue trees for towns and villages, since the trunks or branches are not so apt to break away, it has otherwise little attraction. Of all the species we have, the wood of the Cornish elm is the nearest approach to that of the Canadian rock elm (*U. racemosa*); but perhaps while it is useful for a great number of purposes, it is not so suitable for boat boards as the wych elm.

While the timber of the elm has been the least costly of any hardwood obtainable, and consequently has been in large demand, the uses for which it has been employed have been greater than of any other British-grown hardwood. For the making of coffins immense quantities have been consumed. In the days of wooden ships it was used for keel pieces and in places where it would be in contact with the water, being eminently suitable for both these purposes. The builders of a modern ship, built in 1928, made use of an oak keel piece, bolted to the iron keel by iron bolts, measuring three feet long by three quarters of an inch in diameter. The ship being hauled up for repair, the keel in September 1943 revealed that while the iron bolt was perfectly sound in that portion which had not been in contact with the oak, twelve inches of the rod where it was in contact was entirely disintegrated by the action of acid. An experienced shipwright gave it as his opinion that had the keel been made of elm the iron would have remained sound.

Elm was used in earlier days for water pipes, and only quite recently such pipes were taken up in

Tottenham Court Road and Euston Road, London, and found to be perfectly sound, although they had been in use for more than a hundred years. Some of the actual pipes were exhibited at the Royal Institution a few years since.

Immense quantities have been absorbed for boxes for tinplates, and for seats of chairs and benches, for which elm is admirable. It is used by barge-builders, wheelwrights and for the making of boxes and wagons.

According to Boulger:

"Gerard tells us that formerly longbows were made from the wood of this species, and its tough bark was made into ropes."

Both the Dutch and wych elm are highly esteemed for boat boards, the latter being preferred. It is used extensively for rubbing pieces for the sides of wharves and piers, where its tough grain provides resistance to blows, and its durability under water is exceptional; for the wooden walls of farm buildings, and houses, and has been employed for floorings, but its use for the last-named cannot be recommended. Formerly it was used for chests and partitions for storing all kinds of farm produce and utensils; and for steps and staircases in buildings of all kinds, but for this use it has fallen into disrepute, as the wood will expand and contract with the changes of atmosphere, and is liable to the attack of fungus and beetle. In country places it has been used for pews and seatings in churches, but is generally found severely damaged by lyctus and xestobium beetles.

Throughout Austria and Hungary it has been largely employed for interior house decoration of all kinds, and held there in great esteem. Of late years it has been in demand for high-class work in panelling, etc., in London and elsewhere, being specified by well-known architects. It is doubtful whether the high cost of manufacture, the difficulties arising in seasoning, and its uncertain behaviour after completion, warrant its continued use. In this direction the wood of the Dutch elm was found more satisfactory than of either wych or common elm, both the latter giving trouble.

Elm burrs, carefully selected, as many are too faulty for use, have provided, nevertheless, a limited quantity of most attractive specimens for ornamental woodwork, and a good elm burr will compare favourably for such work with any other kind of wood which can be employed. Elwes mentions many notable examples, and during the last twenty years elm burrs have been in great demand and have commanded high values. Probably the greatest quantity absorbed in one effort was the decorative woodwork for the S.S. *Queen Mary*, where hundreds of flush doors were faced with elm burr, also the dado panelling of the main staircase, the panelling of the main hall and the writing rooms. Some of these burrs were exceptionally fine, the colour varying from a golden to a deep reddish-brown, but always attractive. Whereas in general the work stood well, a certain number of the flush doors cracked and blistered. The very unusual strain on any wood subject to the changes of atmosphere and climate of a sea voyage, and especially that of the Atlantic, suggests that an elm burr which has been found to stand wear and tear in the ordinary way is scarcely the best medium to be employed for ocean-going ships.

A Frenchman, Bernard Palissy, in the sixteenth century, said:

"I have often wished to make a list of the arts which would cease if there was no longer any wood, but when I had written down a large number of them, I found there would be no end to the enumeration, and, after due consideration, I came to the conclusion that there was not even one trade which could be carried on without wood."

Fortified by the Act of Parliament which made it a capital offence to cut a tree down, confirmed by Elizabeth in the sixteenth century, for nearly two hundred years planting of trees was encouraged and practised throughout the country. Science applied to forestry was not thought of, nor were scientific methods employed. Can we rise to the occasion, recognizing to the full the disastrous consequences of delay, following scientific methods and instituting and carrying on a wide embracing measure of re-afforestation?

G. M. Trevelyan has said:

"In matters of amenity (the) Government in our island is by long tradition heartless and witless. In old days this did not matter, because then landlords were able to beautify the country-side with country houses, parks, avenues, gardens, well-kept agricultural estates, and above all with plantations or old English forest trees". . . as they seldom will today.

and further:

"It (the Government) should charge itself with a generous policy of planting the slow-ripening forest trees of England. The State will still be there in time to come to enjoy their financial value, and the English people will still be there to enjoy their beauty. The Government ought to charge the Forestry Commission with this policy on a large scale."

Those of our legislators who reach a position of power over the destiny of the country should recognize the alarming situation. England without her woodlands could no longer maintain her people.

It is a curious thing that although the planting and care of trees is little thought of, our people—men, women and often children—have always displayed the utmost interest, and even a possessive attitude towards the old trees which have been familiar to them from their youth upwards: the former of these two strange characteristics has no doubt insensibly continued from the time when the British were tree worshippers and practised only the religion of the Druids. The latter, however, should be more seriously considered, because it is evidence of a valuable instinct which wiser Governments might have seen and fostered. Illustrating the foregoing, an elm tree in a village in Hertfordshire displayed a large burr which the Lord of the Manor sold. When the men came to fell the tree the villagers prevented them. By order of the Lord of the Manor the men returned in the small hours of the morning, whereupon the villagers set the tree on fire and destroyed it, rather than their cherished tree should pass into the hands of a stranger.

Since the time of Evelyn (*circa* 1660) successive Governments, while neglecting the subject of forestry, have continued to tax more and more heavily those few owners of woodlands, without the least regard to the well-being of the community. A contrary policy, wisely followed, even had it only been adopted throughout the last fifty years, would by now have provided a revenue for the remission of taxation, instead of increasing the already heavy burden.

ORGANIZATION OF SCIENTIFIC AND INDUSTRIAL RESEARCH IN INDIA

TWO articles on the Government organization of scientific and industrial research in India appear in the July issue of *Science and Culture*. One of these describes the present organization, which now comprises the Board of Scientific and Industrial Research, the Council of Scientific and Industrial Research, the Industrial Research Utilization Council and the Committee for the Publication of a Dictionary of Raw Materials. The Council is the supreme body, the Board having now been reduced to the position of an advisory body for scrutinizing schemes of scientific research. A large number of sub-committees are appointed from time to time to act as auxiliary advisory sub-committees to the Board and Council, while the Industrial Research Utilization Council advises on the utilization by the industries of researches completed by the Board. The Board maintains a research laboratory which was transferred to Delhi in 1942.

The article, in a critical review, directs attention to the defects of the present organization, notably the overlapping in the functions of the officers and the absence of co-ordination, the complicated procedure for dealing with research schemes and proposals, and the absence of any continuous programme of research and of a national laboratory. The writer of the article contrasts the development of the organization with that of the Department of Scientific and Industrial Research in Great Britain, drawing freely on an article marking the twenty-fifth anniversary of the Department which appeared in NATURE of May 11, 1940, and stresses the importance of administration being in the hands of professional scientific men, of enlisting the active co-operation of all scientific talent in the country, of establishing numerous research laboratories for the study of subjects of national importance which cannot be carried out in the university laboratories, and of encouraging researches in pure sciences and raising a large research personnel by the establishment of many research fellowships and stipends under university professors.

The second article outlines proposals for reform. A Department of Scientific and Industrial Research, with the status and rank of an "Attached Department" to the Commerce Department of the Government of India, should be constituted. The principal executive officer should be a full-time secretary who should be a senior scientific man with administrative abilities and a good record in scientific research. The Council of Scientific and Industrial Research should be the parent body, and its functions should be to lay down broad features of policy, receive grants from the Government and consider the reports of the Scientific and Industrial Advisory Boards. It should encourage and promote scientific and industrial research, suggest measures for the development of agriculture and industries, and promote scientific works of national importance. The Council should be assisted by two principal advisory boards, taking the places of the present Board of Scientific and Industrial Research and the Industrial Research Utilization Council, respectively. The Scientific Advisory Board should have a distinguished non-official scientific man as chairman and members drawn from eminent men of science representing different sciences, and should be the principal body for supervising and laying down programmes for scientific and industrial research, with a scientific man as full-time secretary.

The present research committees should be reorganized, with separate secretaries, and should prepare the programmes of research in their respective fields for the guidance of the Scientific Advisory Board. The research institutes should be under the direct supervision of the Department, and the directors of research would be directly responsible to the Council and act as secretaries of the respective governing bodies of their Institutes. The Industrial Advisory Board should be the main body for advising on all matters concerning the utilization of researches, establishment of new industries, etc., with a non-official industrialist as chairman and an industrial economist as secretary. The Industrial Exploratory Committees should be under the Industrial Advisory Board. There should be a board of assessors for sanctioning the work of the various bodies and laboratories under the Department with a membership of industrialists, scientific men, representatives of Government Departments concerned and some members of the Legislature.

CONTROL OF THE INSECT ENEMIES OF LAC

IT is estimated that insect enemies destroy about 40 per cent of the total lac crop in India every year. The importance of this feature is all the greater for the reason that the people affected by the loss are mainly the poorest cultivators of the country. The chief insect enemies are predators and parasites: the first-named include the larvæ of two species of moths and the parasites are represented by more than eight species of Chalcid wasps. There are three general methods of controlling such enemies—biological, cultural and artificial controls. The principle of biological control has not so far been adequately investigated as regards the lac insect. Cultural methods, although useful, have greater limitations. Artificial methods, on the other hand, are valuable either independently or in conjunction with either of the other two methods. With regard to artificial control, fumigation is a well-known and efficient means, but it is not possible for the Indian cultivators to resort to it unless properly organized fumigation centres are maintained by an outside authority in every village or group of villages. The other method of artificial control is water-immersion.

This subject is discussed by P. S. Negi in Bulletin No. 50 (1942) of the Indian Lac Research Institute. The advantage of this means of control is its ease of application, involving practically no extra expense. It requires only water for immersion and sunshine for the subsequent drying of the lac. It is recommended that the shoots bearing the lac be submerged to a depth of at least two feet for a period of three days either in running water or in stagnant pools This procedure prevents a large number of insect enemies emerging from the lac when stored. The lac is, moreover, more easily scraped from the twigs after such immersion. Shellac manufacture, and physical as well as chemical tests, show that the yield and properties of shellac are not adversely affected by the water-immersion.

FORTHCOMING EVENTS

*(Meetings marked with an asterisk * are open to the public)*

Monday, November 29

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. H. A. Cox: "Timber—Uses New and Old" (Cantor Lectures, 2).

ASSOCIATION OF AUSTRIAN ENGINEERS, CHEMISTS AND SCIENTIFIC WORKERS IN GREAT BRITAIN (at Austrian Centre Swiss Cottage, 69 Eton Avenue, Hampstead, London, N.W.3), at 7.15 p.m.—Mr. John F. Shipley: "The Role of Meteorology in Engineering Enterprise".

Tuesday, November 30

INSTITUTION OF CIVIL ENGINEERS (STRUCTURAL AND BUILDING ENGINEERING DIVISION) (at Great George Street, Westminster, London, S.W.1), at 5 p.m.—Dr. Oscar Faber: "Difficulties Encountered and Overcome in connexion with Constructional Works".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Prof. J. C. Drummond: "Food Problems of the Post-War Years", 2: "Food Research".*

Wednesday, December 1

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mrs. Goldsworthy: "Education To-day and To-morrow", 2: "Nursery and Infant Schools".

SOCIETY OF CHEMICAL INDUSTRY (FOOD GROUP) (joint meeting with the SOCIETY OF PUBLIC ANALYSTS) (at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1), at 2.30 p.m.—Dr. J. C. Drummond, Dr. H. E. Cox and Dr. E. B. Hughes: "Nutrition of the Public and Food Legislation".

GEOLOGICAL SOCIETY OF LONDON (at Burlington House, Piccadilly, London, W.1), at 3 p.m.—Scientific Papers.

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Dr. T. S. Littler: "Electrical Hearing Aids"; Mr. C. M. R. Balbi: "A Basis for the Prediction of Performance of Hearing Aids".

Thursday, December 2

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Science Museum, Exhibition Road, South Kensington, London, S.W.7), at 2.15 p.m.—Symposium on "Film Classification, Conservation and Projection".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Prof. W. Perceval Yetts: "Links between Ancient China and the West: a Study of Exchanges in Material Culture", 2: "Ancient Commerce with the West".*

CHEMICAL SOCIETY (joint meeting with the UNIVERSITY COLLEGE PHYSICAL AND CHEMICAL SOCIETY) (in the Chemistry Lecture Theatre, University College, University Park, Nottingham), at 4 p.m.—Dr. H. J. Emeléus: "Some Properties and Reactions of Anhydrous Hydrofluoric Acid".

Friday, December 3

ASSOCIATION OF APPLIED BIOLOGISTS (at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1), at 11.15 a.m.—Discussion on Slugs (to be opened by Mr. E. F. Barnes and Mr. D. C. Thomas).

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5 p.m.—Dr. C. C. Paterson, F.R.S.: "Dies from Diamonds and their Use: a Triumph of Technical Precision".

INSTITUTION OF MECHANICAL ENGINEERS (APPLIED MECHANICS GROUP) (at Storey's Gate, St. James's Park, London, S.W.1), at 6 p.m.—Dr. L. Fox and Dr. R. V. Southwell, F.R.S.: "On the Stresses in Hooks and their Determination by Relaxation Methods".

CHEMICAL SOCIETY (at the Royal Technical College, Glasgow), at 7.15 p.m.—Prof. G. M. Bennett: "Some Aspects of the Formation of Ring Compounds".

Saturday, December 4

GEOLOGISTS' ASSOCIATION (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Dr. Alan Wood: "Basic English and its use in Geology" and "Organs of Reproduction in the *Solenoporacea*".

SHEFFIELD METALLURGICAL ASSOCIATION (joint meeting with the SHEFFIELD SOCIETY OF ENGINEERS AND METALLURGISTS and the IRON AND STEEL INSTITUTE) (at the Royal Victoria Station Hotel, Sheffield), at 2.30 p.m.—Discussion on the Fourth Report of the Oxygen Sub-Committee.

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

TECHNICAL OFFICER to work in a particular district of the county—The Secretary, Berkshire War Agricultural Executive Committee, 1 Abbot's Walk, Reading (December 3).

EDUCATIONAL PSYCHOLOGIST—The Secretary for Education, Education Offices, York (December 4).

LABORATORY TECHNICIAN FOR THE VETERINARY LABORATORY—The Secretary, Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh (December 7).

VETERINARY OFFICERS to fill vacancies in Government and other services in New Zealand—The High Commissioner for New Zealand, 415 Strand, London, W.C.2 (December 13).

REGIUS PROFESSOR OF ZOOLOGY at Glasgow University—The Private Secretary, Scottish Office, Fielden House, 10 Great College Street, London, S.W.1 (January 17).

ASSISTANT WORKS MANAGER (AERO-ENGINES) for Royal Air Force repairs in India—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.1525.A).

PAINT CHEMIST for service in the Army Overseas—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. F.1790).

LECTURER (Honours graduate) IN MECHANICAL ENGINEERING, and a LECTURER (Honours graduate) IN MATHEMATICS—The Secretary, Woolwich Polytechnic, Woolwich, London, S.E.18.

ASSISTANT MASTER (graduate) FOR MATHEMATICS, SCIENCE AND DRAWING, in the Ashton-under-Lyne Junior Technical School for Boys—The Director of Education, 8 Warrington Street, Ashton-under-Lyne, Lancs.

METALWORK INSTRUCTOR—The Principal, South Dorset Technical College, Newstead Road, Weymouth.

SCIENCE GRADUATE (Reading or Swanley preferred) to teach GENERAL SCIENCE part-time in Day Technical School for Girls and PRODUCE SUBJECTS to Women's Institutes in area of East Kent—The Principal, Technical Institute, Longport Street, Canterbury.

DESIGNER OF VENTILATION EQUIPMENT required by the Admiralty—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.1874A).

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

London Bird Report for 1942: an Annual Report on Bird-Life within Twenty Miles of St. Paul's Cathedral. Edited by R. S. R. Fitter and E. R. Parrinder. Pp. 24. (London: London Natural History Society, c/o London School of Hygiene and Tropical Medicine.) 1s. 6d. [1916

Bibliography of Meteorological Literature. Prepared by the Royal Meteorological Society with the collaboration of the Meteorological Office. Vol. 5, No. 4, July–December 1942. Pp. ii+47–70. (London: Royal Meteorological Society.) 2s. 6d. [1916

British Association: Committee on Post-War University Education. A Note on Universities and the Education of Teachers. Pp. 9. (London: British Association.) 6d. [2010

Federation of British Industries. Industry and Research: Report of the F.B.I. Industrial Research Committee. Pp. 24. (London: Federation of British Industries.) [2010

Scientific Proceedings of the Royal Dublin Society. Vol. 23 (N.S.), No. 16: Atmospheric Pollution in Dublin during the Year 1942. By A. G. G. Leonard, Bridget P. McVerry and D. Crowley. Pp. 164–170. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) 1s. [2110

Other Countries

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 151: The Control of St. John's Wort (*Hypericum perforatum* L. var. *angustifolium* D.C.) by Competing Pasture Plants. By R. M. Moore and A. B. Cashmore. Pp. 23+5 plates. Bulletin No. 156: Standardized Plant Names; a List of Standardized Common Names for the more Important Australian Grasses, other Pasture Plants, and Weeds. Pp. 99. Bulletin No. 160: The Outbreak of the Australian Plague Locust (*Chortoicetes terminifera* Walk.) in the Season 1939–40, with Special Reference to the Influence of Climatic Factors. By Dr. K. H. L. Key. Pp. 40. Bulletin No. 163: Transmission of Potato Virus Diseases. 1: Field Experiment with Leaf Roll at Canberra, 1940–41, by Dr. J. G. Bald and D. O. Norris; 2: The Aphis Population of Potatoes at Canberra during 1940–41, by D. O. Norris and Dr. J. G. Bald. Pp. 32. Industrial Chemistry Circular No. 2: Investigation of Low-Tin and Tin-Free Solders. By H. W. Worner, H. T. Greenaway and J. H. Buckley. Pp. 16. Industrial Chemistry Circular No. 3: Melting and Casting of Magnesium Alloys. By H. A. Stephens. Pp. 28+4 plates. (Melbourne: Government Printer.) [2190

Asutosh Museum Series No. 2: Museum Method and the Process of Cleaning and Preservation. By Minendra Nath Basu. Pp. viii+36. (Calcutta: University of Calcutta.) [2190

Report of the Haffkine Institute for the Years 1940 and 1941. By Lieut.-Colonel S. S. Sokhey. Pp. ii+84. (Bombay: Government Printing and Stationery Office; London: High Commissioner for India.) 6 annas; 8d. [2190

Indian Association for the Cultivation of Science. Annual Report for the Year 1942. Pp. 18+22. (Calcutta: Indian Association for the Cultivation of Science.) [2190

Smithsonian Institution. War Background Studies, No. 14: Islands and Peoples of the Indies. By Raymond Kennedy. (Publication 3734.) Pp. iv+66+21 plates. (Washington, D.C.: Smithsonian Institution.) [2190

Proceedings of the American Philosophical Society. Vol. 86, No. 1 (September 25, 1942): The Early History of Science and Learning in America; Papers read before the American Philosophical Society, Midwinter Meeting, February 13–14, 1942. Pp. iv+204. Vol. 87, No. 3 (July 14, 1943): Thomas Jefferson; Papers read before the American Philosophical Society in celebration of the Bicentennial of Thomas Jefferson, Third President of the Society, Annual Meeting, April 22, 23 and 24, 1943. Pp. iii+199–290+7 plates. (Philadelphia: American Philosophical Society.) [2190

Catalogue

A Catalogue of Books on a Variety of Subjects suitable for Presentation together with a selection of New and Recent Books. (No. 615.) Pp. 24. London: Bernard Quaritch, Ltd.) 1d.